BY ORDER OF THE SECRETARY OF THE AIR FORCE

AIR FORCE HANDBOOK 36-2235 VOLUME 3

1 NOVEMBER 2002

Personnel

INFORMATION FOR DESIGNERS OF INSTRUCTIONAL SYSTEMS

APPLICATION TO ACQUISITION

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This volume provides information and guidance to ensure that the Instructional Systems Development (ISD) process is properly applied during defense acquisition. This handbook is a guide for Air Force personnel who acquire defense systems and the training to operate and support those systems.

Chapter 1
GENERAL INFORMATION

Overview

Introduction

This handbook serves as a guide for applying the Instructional System Development (ISD) process in defense systems acquisition. It follows the principles of AFPD 36-22, AFMAN 36-2234, and other policy documents. It is intended as an easy reading guide for the novice to ISD, as well as the veteran. While it is designed as a "stand-alone" document, you must also be familiar with the referenced policy documents.

Background

In the past, application of ISD to defense system acquisition has not necessarily been an orderly or well-thought-out process. Sometimes training was considered at concept exploration while in extreme cases it may not have occurred until after the system was fielded. As a result of these variances, the quality and depth of training coverage varied widely from program to program.

Purpose

The purpose of this handbook is to incorporate the applicable regulations and manuals into a handbook that covers the major phases of the ISD process and addresses them to the various phases of defense system acquisition. The ISD process has application in all acquisition phases, but the major effort occurs between the demonstration and validation phase, and the production and deployment phase (Figure 1). The acquisition cycle can last ten years or more, requiring frequent coordination and evaluation, revisiting prior effort and redirecting as required.

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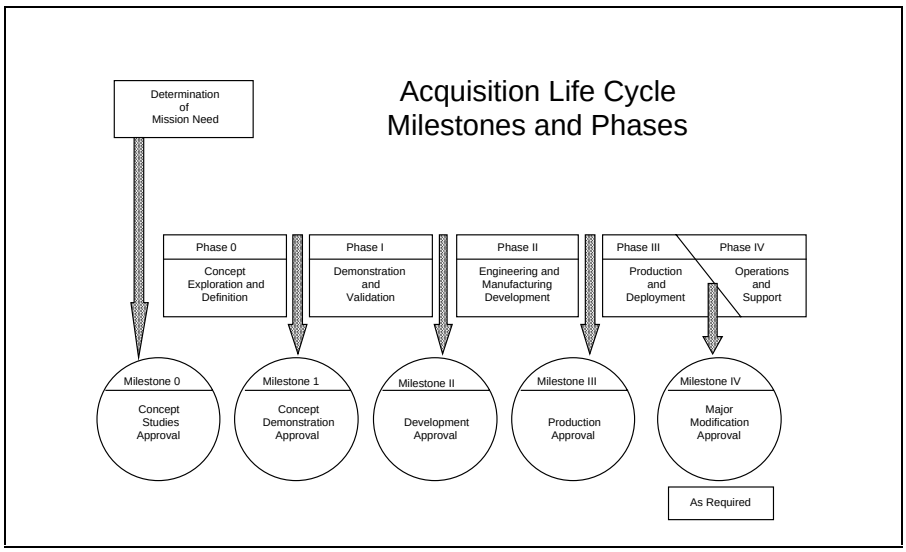
Purpose (Continued)

Figure 1 System Acquisition Life Cycle



Is this handbook for you?

This handbook addresses the question, "How do you apply ISD in defense system acquisition?" It applies whether the instruction is contractor-developed or Air Force-developed. But, is it for you?

Do You …	Yes	No
Ensure that contractor deliverables in the training arena meet contract requirements?		
Review instructional products throughout the phases of ISD?		
Monitor contractors extensively?		
Develop training Requests for Proposals?		
Train engineers, analysts or others to monitor ISD during an acquisition?		
Develop training during the acquisition or major modification of defense systems?		

Continued on next page

Is this handbook for you? (Continued)

Are You …	Yes	No
A training analyst or psychologist with some experience in ISD and an "expert" instructional designer?		
A program manager, system engineer, or analyst with experience in hardware/software issues but little experience with ISD?		
A novice or entry-level engineer with little practical experience in training?		
A novice or entry-level acquisition manager with little practical experience in training?		

If you checked **YES** to any of these questions, this handbook will help you do your job.

How to use this handbook

This handbook is a guide. It incorporates various ISD regulations to try to make your job easier. But you still must read the applicable regulations and references. Use this handbook by thinking about your specific assignment and use the examples to develop your products. The following questionnaire will assist you in identifying the sections you need to read.

Do You Have To …	Yes	No	Page
Participate in training planning teams?			19
Develop system-training concepts?			22
Develop system-training plans?			24
Conduct acquisition strategy analysis?			26
Develop quality plans?			36
Perform systems engineering duties?			44
Assess instructional needs?			63
Develop overall training outlines?			65
Define planning requirements?			67
Conduct task analysis?			73
Conduct training requirements analysis?			75
Conduct objectives analysis?			78
Conduct media analysis?			80
Conduct cost analysis?			83

Continued on next page

How to use this handbook (Continued)

Do You Have To …	Yes	No	Page
Conduct training system basis analysis?			86
Develop syllabi?			89
Write system-level development plans?			94
Conduct development activities leading to system design review?			102
Conduct incremental lesson production activities?			114
Conduct incremental tests?			118
Conduct iterative remedies and retests?			123
Conduct on-site reviews?			127
Implement system functions?			128
Conduct formative evaluations?			137
Conduct summative evaluations?			138
Conduct operational evaluations?			140

What is ISD?

Instructional System Development is a deliberate and orderly, but flexible process used for planning, developing, implementing, and managing instructional systems. It ensures that personnel are taught in a cost-efficient way the knowledge, skills, and attitudes essential for successful job performance. ISD helps to validate that:

There is a training need.
There is an effective and efficient solution to the need.
The solution can be implemented.
The solution can be assessed to determine whether it meets the need.
During the development and operation of an instructional system, there is a total continuing requirement for technical and management improvement.

Basis for ISD

ISD is based on:

Basic research on how people learn
Basic research on how people communicate
The systems engineering process
The development of media and computer technologies

Why use ISD?

Instruction must be planned if it is to be effective. ISD requires that:

Job tasks and mission requirements are analyzed.
The target population to perform the job is analyzed.
The difference between what the target population can do now vs. what they must be able to do to perform the job is identified as training requirements.
Training requirements are addressed by a hierarchy of training objectives.
Training objectives are achieved through media and methods.
Media and methods are selected to optimize efficiency and effectiveness of training.
Training courses are developed and validated to ensure that training objectives are met.
There is a continuous feedback loop throughout for quality improvement.

Goals of ISD

The goals of ISD are to produce students who can perform their jobs after receiving instruction, and to reduce overall costs of training by accurately identifying training requirements and equipment.

How to use ISD

ISD is:

Flexible and systematic
A tool to develop the right training to solve the problem

ISD is NOT a step-by-step linear process.

Don't have a "checklist mentality" when you're using ISD.

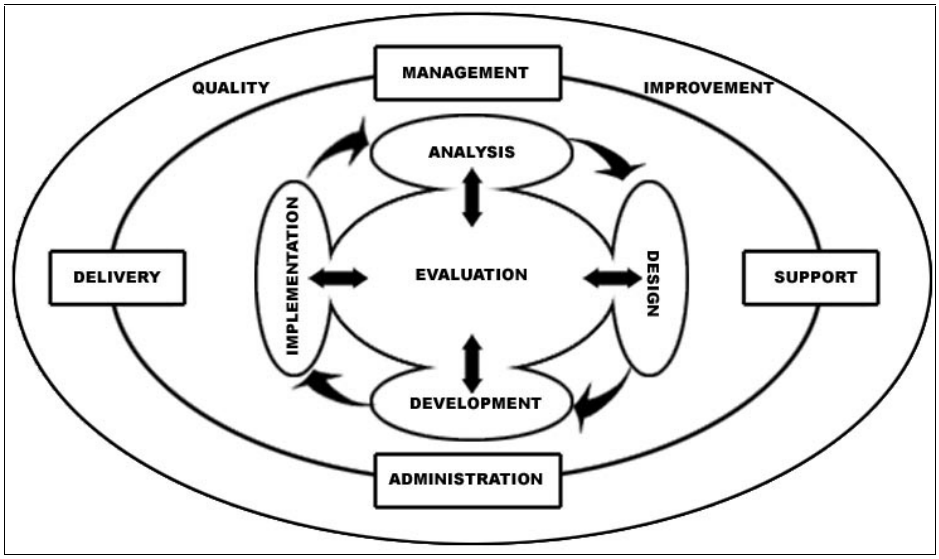
You need to think of ISD as being circular. You can start anywhere at any time, as the need requires. During each phase of the ISD process, you continually assess the quality of the process and any product input. Evaluation is ongoing throughout the life cycle of the training system. The updated Air Force ISD

Continued on next page

How to use ISD (Continued)

model is depicted in Figure 2. Although each part of this model is explained in AFMAN 36-2234, further discussion tailored to acquisition is included in this handbook.

Figure 2 Updated ISD Model



What is a total training system?

A total training system is a systematically developed curriculum including, but not necessarily limited to, courseware, classroom aids, training simulators and devices, operational equipment, embedded training capability and personnel to operate, maintain or employ a system. The training system includes all necessary elements of logistic support. This is covered in more detail in Chapter 2.

Quality improvement

Quality improvement, with an emphasis on evaluation throughout the life cycle of the program, is the glue that holds the total system together. Figure 2 shows the updated ISD model with quality improvement and system functions.

What are system functions?

Successful training systems must have basic top-level functions, and these functions must be in place before a training system can operate. The basic training system functions are discussed in the following paragraphs and are depicted in Figure 3.

Continued on next page

What are system functions? (Continued)

Management. This is the function of directing or controlling all aspects of the training system. These activities are an integral part of conducting training.

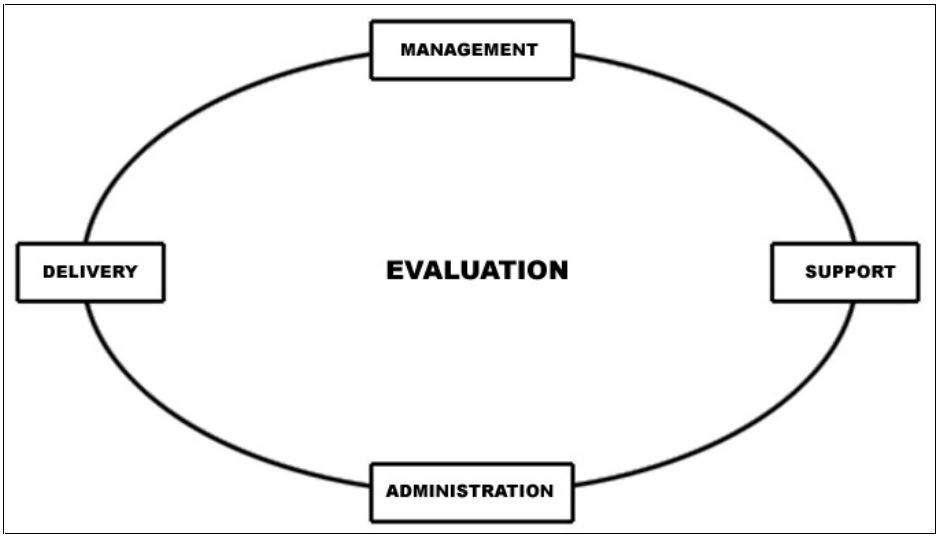
Support. This provides for and maintains the system on a day-to-day and long-term basis. This includes long-range planning as well as day-to-day activities. Examples are resources you need to keep equipment functioning, such as an equipment maintenance contract.

Administration. This is the part of management that performs the day-to-day tasks of operating an instructional system. This includes functions such as documentation, student assignments, and student records.

Delivery. This is the means of giving students the training. Instructors, computers, and textbooks are examples of ways to deliver instruction.

Evaluation. This function is the continuous process of gathering feedback data through formative, summative and operational evaluations to assess the system and, most important, student performance.

Figure 3 System Functions



When do you implement them?

The system functions must be working before you start the training. Aspects of the training system functions are active throughout all phases of ISD.

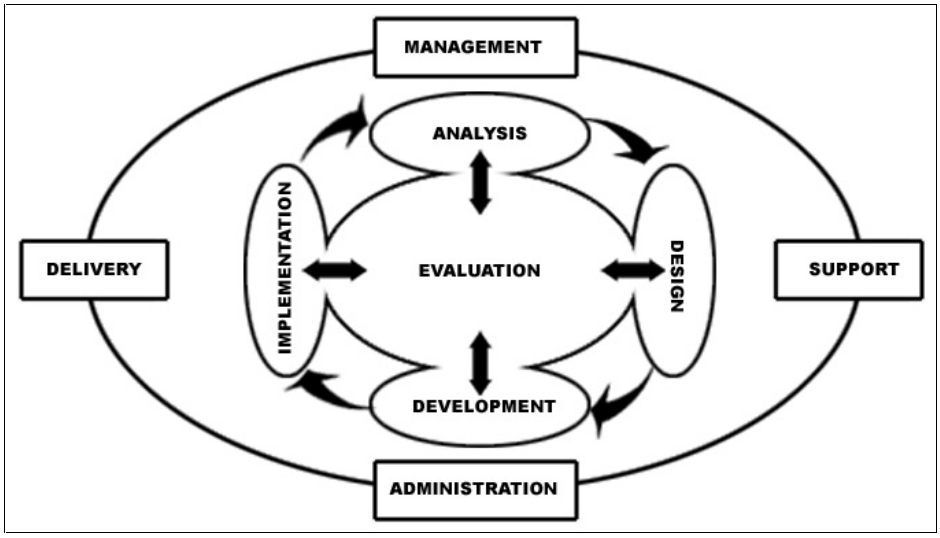
Relation to ISD

Using these essential functions to design the overall training system architecture and then allocating them to the respective system components, or people responsible, ensures that these functions are operational when the total training system is fielded. ISD products are integrated into the total training system, and aspects of the system functions are active throughout all phases of the ISD process.

System functions and ISD phases

Figure 4 shows the phases most often used in the systems approach, which are analysis, design, development, and implementation, with the evaluation activities integrated into each phase of the process. The phases are embedded within the system functions. Evaluation is shown as the central feedback "network" for the total system.

Figure 4 Functions with Phases



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System functions and ISD phases (Continued)

The instructional development process, which the model summarizes, calls for instructional developers to:

Analyze and determine what instruction is needed.
Design instruction to meet the need.
Develop instructional materials to support system requirements.
Implement the instructional system.

Evaluation is a central function that takes place at every phase. Symbolically, Figure 4 shows that all phases of the model depend on each of the other phases. The ISD process allows the instructional developer or design team to enter or reenter the various phases of the process as determined by the nature and scope of the development or revision activity. The phases of the updated model are described in more detail in separate chapters of this handbook.

Evaluation

Evaluation is a continuous process beginning during the analysis phase and continuing throughout the life cycle of the instructional system. Evaluation consists of:

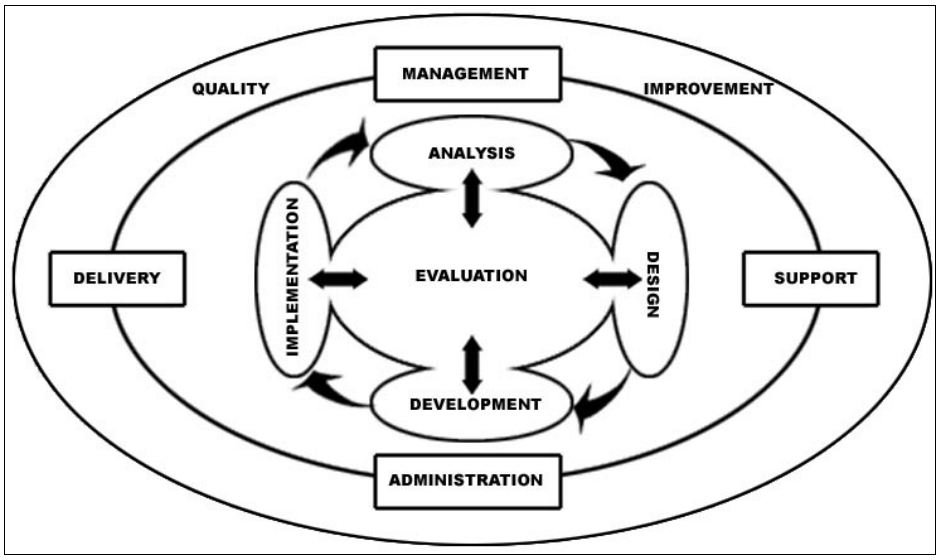
Formative Evaluation, consisting of process and product evaluations conducted during the analysis and design phases, and validation, which is conducted during the development phase. Included are individual and small-group tryouts.
Summative Evaluation, consisting of operational tryouts conducted once the entire training system is fielded.
Operational Evaluation, consisting of periodic internal and external evaluation of the operational system during the implementation phase.

Each form of evaluation should be used during development, update, and revision of instruction, if possible, and if the form of evaluation is applicable.

Updated AF ISD model

Figure 5 depicts the updated Air Force ISD model. This completed figure shows the system functions and ISD phases embedded within the quality improvement (QI) process.

Figure 5 Updated AF ISD Model



The updated model graphically illustrates that:

Evaluation is the foundation of the ISD process.
ISD is a continuous process with the flexibility to enter and reenter the various phases, as necessary, to develop, update, or revise instruction.
All ISD activities take place within and are dependent on the system functions.
Teamwork is required between personnel performing system functions and those designing, developing, and implementing instructional systems.
All ISD activities and system functions focus on continuous quality improvements in the system.

Quality improvement

Although Quality Improvement (QI) is covered in detail on page 36, you should remember that QI is the continuous, organized creation of beneficial change to the system. The objective of QI is to foster continuous improvements in the process and products of ISD.

Chapter 2
TOTAL TRAINING SYSTEM

Overview

Introduction

Fielding a new defense system with a total training system is a project that requires considerable management, coordination and integration. Lessons learned in fielding total training systems have shown that organizations responsible for integration of the training system have been left scrambling. Why? Because important and sometimes even critical functions were overlooked early in the overall design. The shortfalls range from "common sense" such as failing to analyze student production requirements, to "technical" such as improper integration of out-the-cockpit visual system design with the design of the simulator.

Analysis of successful programs concluded that there are basic top-level functions required for operation of a total training system.

Purpose

The purpose of this chapter is to explain the total training system concept in the context of instructional system design. These concepts apply whether you are buying a total system or parts of a system, a new defense system or a modification.

Where to read about it

The overview of total training system acquisition is explained in the following sections.

What is a total training system?

As mentioned earlier, a total training system is a systematically developed curriculum. The training system includes all necessary elements of logistic support. In order to acquire a total training system, follow the instructional system development process interacting with the systems engineering process.

There is no perfect model

No model is the "perfect" model. Variations of each model may be used to best meet the objectives for the training being developed.

Section A
Acquisition Concept Definition

Introduction

Acquisition is the obtaining of supplies or services, by and for the use of the federal government, using appropriated funds. Before acquiring these supplies and services, you must evaluate the constraints and opportunities to make a sound decision. Once the decision to acquire something (rather than obtaining it through internal development) is made, an overall approach to the acquisition should be developed.

Purpose

The acquisition concept serves as a starting point from which other activities originate. The activities generated by a decision to lease supplies or services can be very different from those generated by a decision to purchase them. Other factors that can change acquisition activities are sole sourcing, competitive contracting, research and development, dual sourcing, and other contracting methods.

Where to read about it

Prior to making a decision whether or not to obtain defense system training through acquisition, the process leading to the decision has begun. Important aspects of this process are described under the topics listed below.

Training System Requirements Studies Initiation

Introduction

To ensure proper planning and development, Training System Requirements (TSR) must be considered early in the cycle of defense system acquisition. For this reason, preliminary training consideration should begin in the pre-concept phase of system acquisition. At this time, the defense system using command will form and chair the Training Planning Team (TPT). Once the defense system is defined in the demonstration and validation phase of acquisition, TSR studies are initiated. A Training System Requirements Analysis (TSRA) is a systematic approach to front-end analysis of a training system based upon an integrated instructional systems development/systems engineering process that develops data items to document the training and preliminary system requirements.

Purpose

The purposes of the TSR studies are to:

Determine training need.
Outline the "big picture."
Define training requirements.
Define thoroughness of data and analysis.
Involve defense system contractor in training issues early on.

What are training requirements?

Training requirements are determined by comparing the skills and knowledge requirements needed to do a job, to the current abilities of the persons expected to do the job. The difference between those current attitudes, abilities, knowledge, and the skills necessary to perform specific tasks in order to operate, maintain, and support a defense system are the training requirements.

Further explanation

There are several areas to consider when deciding on the TSR study approach. For example, is a TSR study really needed? If so, to what depth? Should the TSR study be done by an independent contractor or the training system development contractor (phased approach)? Have alternative acquisition strategies been identified to allow for consideration of innovative solutions to the training need? The TSR study lays the foundation for the ISD process. (Further information is available as each document is explained in this handbook.)

Training Planning Team

Introduction

Coordination and communication are the keys to success in any program, and are most critical in the training business. The formation of a Training Planning Team (TPT) helps keep the many players working together to reach the training system objectives.

What it is

A **Training Planning Team** (TPT) is defined as an action group composed of representatives from all pertinent functional areas, disciplines, and interests involved in the life cycle of a specific defense training system. The TPT is formed at pre-concept and continues throughout the acquisition and day-to-day operation of the training system. The personnel on the TPT represent the using command, the system program office, and other concerned agencies. The TPT develops and uses the System Training Plan (STP) to ensure that training considerations, constraints and opportunities are adequately addressed in the defense system acquisition modification process.

Objectives

The primary objective of the training planning team is to get the right agencies communicating and coordinating from the very beginning as a team. Once a System Program Office (SPO) is formed, the TPT bridges between the SPO and the operating command. The goal is to develop the STP and keep it current throughout the life of the defense system.

Who is responsible?

The primary operating command will establish and chair TPTs throughout the life cycle of the defense system. The program office (normally AFMC) will support and assist the chair as required. The using command will also be responsible for developing a Manpower Estimate Report (MER) following acquisition guidelines.

Note: The training wheels were put into motion prior to the formation of the SPO. Training was specified in the Program Management Directive (PMD), which is the primary document that directs the program office to begin a system acquisition. Using the PMD, the program office develops a Program

Continued on next page

Who is responsible? (Continued)

Management Plan (PMP) which outlines responsibilities and general management objectives. As part of PMP development, all applicable MAJCOMs provide inputs. While the SPO and primary operating command are considered the prime players, Air Education and Training Command (AETC) has a key role. This is true even if the training system will be contractor procured, developed and operated.

Requirements and responsibilities

Air Force Pamphlet 50-11 details specific requirements and responsibilities for the training planning team.

Other responsibilities

Acquiring training is a complex process involving many agencies and personnel. As stated earlier, while the operating command and the program office are the two major players, many other key offices are involved. For example, AETC plays a key role that varies depending on the nature of the training involved. AETC normally will:

Be a member of and support the TPT.
Designate an AETC Office of Primary Responsibility (OPR) for the specific program.
Assist in determining whether all or parts of training will be AETC- or contractor-developed. (If AETC or USAF developed maintenance training, read "Air Force-Developed Maintenance Training" [page 145].)
Designate AETC responsible agencies and define roles.
Designate AETC supporting agencies and define roles.

Note: As mentioned earlier, the TPT continues throughout the life of the defense system. While the TPT may not meet every day, every week, or even every quarter, they will meet frequently enough to evaluate changes in the defense system for their effect on the training system. The TPT will update the STP annually or when changes occur that affect training in:

Tactics
Personnel
Structure
Demographics
Manning levels

Continued on next page

Other responsibilities (Continued)

Defense system
Hardware
Software
Subsystem

Training assets availability
Funding priorities/levels
Basing
Operating commands

The TPT develops and implements alternate training strategies until the training system becomes current again with the defense system.

Whenever possible, advance notice of changes should be provided to the TPT to allow training of personnel prior to implementation of defense system changes.

Training System Concept

Introduction

The development of an overall training system concept is the beginning of a system-training plan. This concept serves as the starting point for all other planning. It provides the framework to develop system requirements, resource requirements, etc.

Objective

The objective of the training system concept is to define the training philosophy and policy within which the training system will be designed and operated. The training system concept includes the characteristics to be exhibited by the overall training system.

Who is responsible?

The operating command, as part of the TPT, is responsible for developing the Training System Concept (TSC). They will be assisted by:

Subject Matter Experts (SME)
Contractors
Instructional designers
System Program Office (SPO) representative
Air Education and Training Command (AETC) representative
Other managers and specialists as required

What is in a TSC?

The TSC is purposely broad, but it sets the boundaries within which training system decisions can be made. It can contain items such as:

Training system life cycle master plan
Training philosophy
Type and amount of training that may be needed
Estimated funding requirements
Estimated training and support equipment needs
Type and size of facilities needed
Estimated time to develop and deliver the system
Projected impacts on personnel
Training constraints

Where to begin

The best way to begin developing a TSC is to review predecessor systems. Look for similarities and differences. What were the lessons learned from those predecessors? Now is the time to identify the expense and time drivers. Many other considerations must be taken to develop the TSC, which leads to process analysis decisions and helps in developing the system-training plan.

System Training Plan

Introduction

The Training System Concept (TSC) starts the System Training Plan (STP). The training planning team is tasked in AFP 50-11 with initiating the STP. The primary operating command is tasked with overall responsibility for the effort.

Objective

The objective of the STP is to support acquisition and modification processes, requirements, documents, and milestone decisions. The STP also ensures that proper training is identified as the mission changes, the defense system changes, or the world situation changes. The STP is a living document.

Description

The STP is a life cycle, iterative planning document that defines the following functions of a training system:

Design
Development
Funding
Resources
Support
Modification
Operation
Management

A STP format is available in AFP 50-11.

Subset plans

The STP is composed of subset plans for each functional area required, such as:

Operations
Logistics
Support

IMPACTS

The STP is included in the IMPACTS Program Plan (IPP) as the training input and submitted to AF/XO for Air Staff coordination.

IPP

The STP is submitted as part of the IPP to SAF/AQ prior to each milestone decision point, or as required, starting with Milestone 1 (see Figure 1).

What does the STP do?

The STP will normally:

Establish training system definition through acquisition and modification documentation, which will support the review and decision process.
Identify training needs, concepts, strategies, constraints, risks, data, alternatives, resources, responsibilities, and other areas, through an iterative process.
Document the results of early, front-end, and follow-on training task analyses.
Provide information and identify resources for management decisions within the planning, programming, and budgeting process which support defense/training system acquisition and modification processes.
Provide the basic concepts and strategy to attain and maintain training system concurrency to support desired training capability at the appropriate time.
Identify alternate training strategies, to include methodology and media, if funding, concurrency, or other unknowns negatively impact required training system capabilities.
Establish milestones and schedules to ensure timely development, testing, and fielding of training capability and training support.

STP development levels

Various development levels are required to support milestone decisions and reviews. See AFP 50-11 for an outline of STP development levels.

Training Acquisition Strategy Analysis

Introduction

At this point, when the TPT is formed and the STP is being written, a preliminary decision will be made on whether to contract for all or parts of the training. Assuming the decision is to have contractors develop at least a part of the training, the command with program management responsibility will develop an acquisition strategy. The acquisition strategy is finalized before each contracted activity.

Things to consider

In developing an acquisition strategy, the following should be considered by the SPO in coordination with the user:

Equipment:
- Current federal acquisition regulations
- Funding availability and constraints
- Defense system schedules
- Complexity of training system
- Types of training being acquired (operator / maintenance / other)
- Sole vs. multiple sourcing
- Lease vs. purchase

Personnel:
- Trained personnel requirements
  - How many? and, When needed?
- On-site training or schoolhouse?
- One-time course vs. life cycle use
- Total contractor training vs. turnkey (using command operation)

Other considerations

Getting the "big picture" is important in developing the acquisition strategy. The total training system perspective is needed to understand its full scope and how the integration will take place in order to have a fully operational system. Though a contracted activity may be treated as independent, the tie into the "big picture" ensures a good fit. Always consider how the training system fits into the overall defense system acquisition. Choosing the wrong acquisition strategy not only affects the training system, but can also cause delays in the defense system testing, support, and initial operational capability.

Section B
Analysis

What you do

During analysis, you should:

Collect information on job performance requirements of Air Force missions/duties/jobs/tasks.
Determine the necessary qualifications of the job performers.

Why do it?

Analysis must be conducted to make sure you get the **right kind of training** for the stated need.

Where to read about it

A detailed discussion of analysis in acquisition is available in Chapter 5. Specific topics are listed below.

Section	Topic	Page
A	Mission Analysis	73
B	Task Analysis	74
C	Training Requirements Analysis	76
D	Objectives Analysis	79
E	Media Analysis	81
F	Cost Analysis	84
G	Training System Basis Analysis	87
H	Preliminary Syllabus	90

When you do it

Do your ISD analysis when you need to get information that will affect your design or when you need to assess trade-offs between alternatives. Do ISD analysis:

Before beginning design development
When defense system changes require instructional system changes
When a more efficient alternative applies
When a more effective approach is suggested
When new instructional technology is to be incorporated

What you get

If you have conducted the analysis correctly, you will get valid task details that describe training requirements and identify potential alternatives for training equipment.

What you need to do it

Systems process is an input-process-output activity.
A variety of subject matter reference data documents determine what type of analysis is needed by providing input.
These documents identify the sources from which data is necessary:

Defense system data
Similar system data
Input from Subject Matter Experts (SME)
Specialty training standards (STS)
Technical Orders (TO)
Logistics Support Analysis (LSA) data
Engineering data
Career development courses (CDC)
Any other reference material that helps you identify duties, tasks, activities, and behaviors for a given job

Section C
Design

What it is

Instructional design is similar to architectural design. You determine what you want the training to look like and how you want it to work. The analysis that you previously conducted will help determine the basic structure; not only for the training system, but also for the defense system it supports. A continuing effort in the design phase is the assurance of quality in the design process and products with an emphasis on improvements, where possible.

Why do it?

Design is conducted to save money, increase the quality of the product and **get the training done on time**. You don't just go out and start developing instruction, just as you don't run right out and start building a house without planning and designing it first.

Where to read about it

A detailed discussion of ISD design is available in Chapter 6. Specific topics are listed below.

When you do it

Design is conducted before beginning to develop the training.

What you get	Proper design will result in: Preliminary syllabus Courseware development plan Key process definition Personnel to do the job Training media (i.e., devices/simulators)
What you need to do it	For ISD design you need all of the planning and analysis phase products that you previously developed.

Section D
Development

What it is

During ISD development you make the instruction and validate it. ISD development acquisition verbs include:

Write (print)
Produce (video or A/V materials)
Program (ICW)
Install (management systems)
Build and validate (devices/simulators)
Validate (instruction)
Revise (instruction)

Why do it?

Development is conducted to have a valid quality product ready for implementation.

Where to read about it

A detailed discussion of development activities is available in Chapter 7. Specific topics are listed below.

Section	Topic	Page
A	Lesson Outlines/Flow Diagrams	114
B	Lesson Strategy/Lesson Plans	116
C	Storyboards	118
D	Coding, Programming, Writing	119
E	Lesson Tests (Individual Tryouts)	120
F	Course-Level Integration Tests	123
G	Small-Group Tryouts	124
H	Iterative Remedy and Retest	126

When you do it

Development proceeds after design and before implementation.

What you get

If done correctly, you will get an instructional product that meets the design specifications for the training requirement. The product will be validated using students from the target population, revised as required, and produced in final form.

What you need to do it

For ISD development you need:

Analysis and design documents and products
Students and equipment for validation
Appropriate tools
Skilled personnel/subject matter experts

Section E
Implementation

What it is

At the ISD implementation phase you begin using the instructional program to train students.

Why do it?

You have an implementation phase for instruction to assure yourself that you are meeting the need.

Where to read about it

A detailed discussion of implementation is available in Chapter 8. Specific topics are listed below.

Section	Topic	Page
A	Site Training Readiness Review	130
B	Implementation of System Functions	131
C	Full-Class Tryouts	136
D	Mature System Performance Review	137

When you do it

Implementation is conducted after validation, revision, and final production of the instruction.

What you get

After implementing instruction, you will have the knowledge that you've helped someone learn a job and be a successful contributor to the Air Force. You will also have satisfied the first objective of ISD by satisfying a training need.

What you need to do it

For ISD implementation you need:

All training system functions in place
Total training system components in place
Trained instructors
Trained training managers

Section F
Evaluation

What it is?

Evaluation is the way to measure the effectiveness of the training. Evaluation answers the questions:

Have the students mastered the objectives?
How well are the course graduates performing in the field?
How can the training be improved?
How well is the process working?

Why do it?

You conduct evaluation after implementation to gain feedback internally and from the field throughout the life cycle of the training to make sure graduates can still perform the job to standards. Evaluation is conducted throughout the acquisition to provide feedback about the quality of the ISD process and the resulting products.

Where to read about it

A detailed discussion of evaluation is available in Chapter 9. Evaluation is discussed throughout this handbook and summarized in the sections listed below.

Section	Topic	Page
A	Formative Evaluation	140
B	Summative Evaluation	141
C	Operational Evaluation	143

When you do it

Evaluation is going on throughout the ISD process and as long as the training program is in place.

What you get

Evaluation will ensure an effective and efficient ISD process with quality ISD products. Evaluation will also provide you with data to ensure that graduates are performing to the expected level. This is done by continuous improvement in the training.

What you need to do it

To properly perform evaluation you need:

Personnel:

- Students
- Graduates
- Trained evaluators
- Field visits
- Interviews

Material:

- Systems
- Courseware
- Equipment
- Questionnaires
- Other items as required

Section G
Quality Improvement

Introduction

ISD is a continuous, systematic process with continuous evaluation. The ISD process is the Air Force tool to ensure that quality systems are built to the customer's satisfaction. It helps managers and training developers build programs that teach what Air Force people need to know, when they need to know it, in the most effective and most efficient manner possible. The ISD process implements all of the principles of the Quality Air Force (QAF) program.

Quality is the vehicle to ensure that training systems are built and delivered customer-centered.

What it is

Quality improvement (QI) is the continuous, organized creation of beneficial change. It occurs throughout the ISD process. Quality improvement results in raising student performance (due to training) to an unprecedented level.

Objectives of QI

The objective of QI is to foster continuous improvement in the ISD processes and products and to ensure on-time development of high-quality courseware that enables students to reach the desired performance levels in an effective and cost-efficient manner. QI occurs throughout the ISD process.

Results of QI

High quality in training product development brings:

- Increased student satisfaction
- Products that are easy to maintain
- Increased ability of students to perform a job immediately after training

High quality in training design brings:

- Fewer errors
- Less rework (and waste)
- More successful training
- Less time spent in developing new products
- Potentially lower life cycle costs

Test and evaluation

Test and evaluation is the check to ensure that system requirements are met according to the specification. It is used as part of the quality process.

Quality relationship

Customers:

Know your customers. The information gained in the mission/job analysis process gives the instructional design team information that defines the customer's expectations.

Focus on customers. As mentioned earlier, the needs of the work center drives the instructional needs. By continuing to trace the relationship between the job requirements and all aspects of the instructional program, you maintain a continual focus on the actual field requirements. In addition, ISD also requires that the capabilities, aptitudes and attitudes of the student target population be considered during the design process.

Team Players:

Foster teamwork. A training program cannot be designed and developed in a vacuum. In order to develop effective training, the design team must include representatives from the work center and evaluation offices. This helps ensure that the training matches the performance requirements of the job.

Empower your people. ISD is a problem solving, decision-making model. The flexibility of the process, combined with the fact that there are any number of ways to solve a given training problem, requires that design teams be allowed freedom and authority to design, develop, and implement training that meets job performance requirements.

Final Product:

Know your mission. ISD depends on mission and job analysis for basic data. All instruction **must** be based directly on mission or job requirements. The checks in the process help eliminate instruction not related to the job.

Job analysis uses data from many sources, including mission statements found in regulations or locally developed statements. Analysts also make use of management

Continued on next page

Quality relationship (Continued)

engineering reports, occupational survey data, and direct observation to determine the actual job requirements.

As part of the job analysis process, a training needs assessment is conducted to arrive at the actual performance problem. In some cases, a problem is not related to lack of training, but to a problem with the job structure or environment. The ISD process helps ensure that you don't build a training program for a non-training problem.

Set goals and standards. Goals and standards for an instructional development effort come in many variations. First, the job requirements and the impact of the performance deficiency determine the timing required for the development process and the conduct of the instructional program. Second, the content of the training is determined by the job performance requirements. The design team should directly translate the cues, conditions, and performance standards of the job directly into the instructional program.

Manage by fact. Each phase of the ISD process requires constant evaluation against the job requirements identified earlier in the process. In addition, a variety of tools have been developed to help ensure that design and development decisions are made with supporting data. For example, a number of media selection tools are being used that provide managers with information that matches training media with the training requirements. These matches are based on learning theories and development cost factors (money and time). ISD is designed to guide managers and developers to awareness of factors affecting their decisions.

Integrate quality in all phases. Evaluation is continuous quality checking. This is true during each phase of the ISD process, from analysis to implementation. Built-in checks in each phase ensure the quality of the ISD process and products. The emphasis is on satisfying the job performance requirements and producing graduates who can do their jobs.

Evaluate quality constantly. The ISD process is a cyclical, ongoing process of continuous improvements. As curriculum developers progress through the different phases of ISD, the process and products of each phase are constantly evaluated against the job requirements and principles of learning. The results of the evaluations determine which phase of ISD to enter next. Constant evaluation identifies changes in job requirements due to updates in equipment and personnel, which results in new ISD efforts to provide the best possible training to Air Force personnel.

Basis of process improvement

The basis of process improvement is Quality Air Force. QAF is a management philosophy and a methodology that work together to produce continuous process improvements. It is based on the following principles.

All work is a process.
Processes receive work from suppliers, add value, and deliver output to customers.
Anyone from whom a process receives work is a supplier.
Anyone to whom a process delivers output is a customer.
Customers have needs and expectations.
Customers will define and measure quality in terms of those needs and expectations.
Quality is meeting customer needs and expectations.
Improving process quality increases productivity.
Processes can be identified, understood, measured, and improved.
The people who operate the processes know best how to improve them.

Procedure for process improvement

In order to ensure process improvements, you will need to use a systematic method to identify and correct the causes of the problems. The six steps of process improvement are outlined in the following table.

Step	Activity
1	Define the process and determine the main problem areas.
2	Analyze the problems and identify the causes of each.
3	Identify and evaluate possible changes to the process.
4	Implement the changes and monitor the process.
5	Institutionalize the changes.
6	Repeat for continuous improvements.

Ways to implement the procedure

There are many different ways to implement the basic procedure mentioned above. Two of the ways are:

"Chart it, check it, change it"
Shewhart Cycle (plan-do-check-act)

Each of these techniques uses the six basic steps mentioned above.

Chart It, Check It, Change It

What it is

"Chart it, check it, change it" is a simple phrase that summarizes one of the ways to implement the procedure. It is a systematic approach to continuous improvement. This approach has three principal steps, as shown below and in Figure 6.

Step	What You Do
1. Chart	Describe the process. Gather data.
2. Check	Analyze the data. Evaluate the process. Identify opportunities.
3. Change	Improve the process. Institutionalize the change.

How to use it

Figure 6 Chart It, Check It, Change It

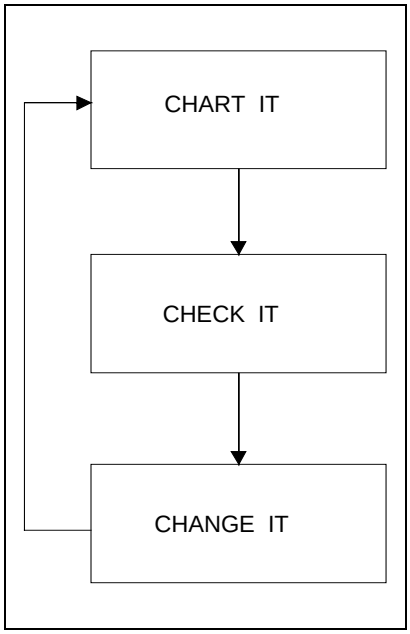


Chart It

Using a process flowchart, describe the process to be improved.
Gather data on the process and its products.

Continued on next page

How to use it (Continued)

Check It

Analyze the data to isolate the problems and opportunities.
Evaluate the process to identify alternative approaches.
Identify opportunities (i.e., useful changes) from the alternatives.

Change It

Improve the process by implementing changes identified as opportunities.
Institutionalize the changes through training, standardization, and other means. Then, use another process (or use this same one again) to make further improvements.

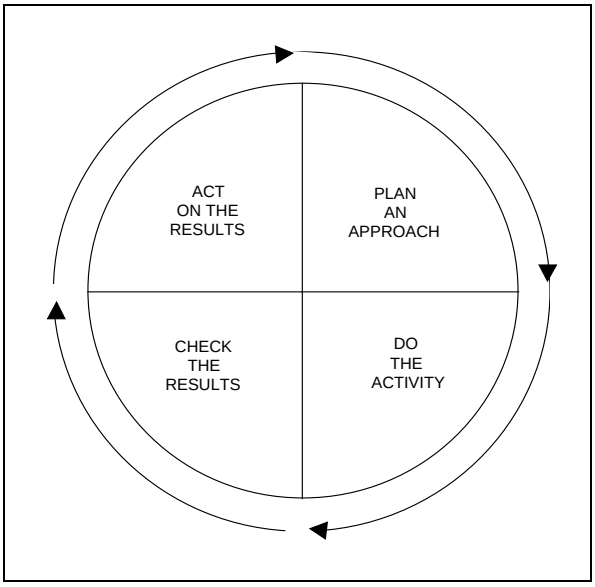
Shewhart Cycle

What it is

The Shewhart Cycle is a systematic approach to achieving a continuous improvement in quality. The cycle includes planning, doing, checking, and acting.

Graphic representation

Figure 7 Shewhart Cycle



How to use it

Because the approach involves repetition, it is represented graphically as a circle in Figure 7.

To use the Shewhart Cycle, follow the steps listed below.

Plan an approach for quality improvement. Study the process flow and any existing data. Formulate possible improvements, experiments to be run, or additional data to be gathered.

Do the activity planned. Implement the improvement effort that you planned. Train the people who are responsible for implementation.

Check the results. Measure the results of the improvement effort you implemented. Analyze the data you collected.

Act on the results. If the effort was truly an improvement, standardize and document it. If it was not successful, determine what could be done to improve it.

Repeat. Continue around the cycle again by planning and carrying out further activity.

Section H
System Engineering Interaction

Introduction

Nothing in the ISD process occurs in a vacuum or at least it shouldn't. It's extremely important that ISD interface with other defense system acquisition/life cycle support functions continuously. One important way that the ISD process meshes with the defense system is through interacting with system engineering. An "interaction" is a two-way street: ISD and system engineering communicate and support each other. But why is it important and how does it happen?

What it is

A **system** is a composite of skilled people and equipment (hardware and software) that provide an operational capability to perform a stated mission.

ISD is the systematic process employed to design and develop training for a defense system. It is used to identify training requirements, to determine appropriate media for training, and to design, develop, implement and evaluate training and training materials for defense systems.

The **system engineering process** is a logical sequence of activities and decisions transforming an operational need into a description of system performance parameters and a preferred system configuration.

Relationship of ISD and system engineering

ISD and system engineering are two complementary processes that are used to design and develop training systems for defense systems. The processes have many similarities and each process accomplishes functions not accomplished by the other.

Importance of ISD to system engineering

System engineering must consider personnel, the skills they require, and the training program to teach these skills as integral parts of the defense system. Failure to integrate ISD into system engineering can result in an inadequately supported system.

System engineering addresses those training system design issues having to do with translation of training system functional

Continued on next page

Importance of ISD to system engineering (Continued)

requirements (stated by ISD) into hardware and software. It considers the defense system hardware, software, support equipment, operations, and maintenance concept. System engineering examines new technology, similar systems, and existing systems to arrive at a functional description of the system in terms of hardware and software requirements. The system engineering process is used to produce the management and design decisions and data upon which the training system is based. ISD alone cannot fulfill all the needs of a total training system.

Interaction

ISD and system engineering are mutually supporting facets of a defense system acquisition and life cycle. All individuals involved with acquisition must ensure that ISD is considered in system engineering and vice versa. Many avenues exist for this interaction. Among them are:

Personnel:

- Training planning team
- Technical interchange meetings

Plans:

- System training plan
- Logistic support plans
- Test plans
- Program development plans

Reports:

- Integrated Manpower, Personnel And Comprehensive Training & Safety (IMPACTS)
- Requests for Proposal (RFP)

Other Considerations:

- Logistic support analysis
- Quality control
- Design reviews

Chapter 3
CONTRACTOR-DEVELOPED TRAINING

Overview

Introduction

During the first two chapters, you were given a basic background of ISD and were introduced to some of the concepts that apply. It was stressed that ISD is a flexible process, always employing the principles of continuous or quality improvement. You have seen how training system requirements must be considered early in the cycle of defense system acquisition. Teamwork, communication, and coordination have been stressed frequently. But at this point, a contract has not yet been awarded and could still be a long time away. In fact, you learned in the previous chapter that a TPT has been formed and that the TPT determines the approach to take for acquiring training to support the defense system. Sometimes it may be in the best interests of the Air Force, for the Air Force to develop the training themselves. If the decision is to have contractors develop all or part of the training, another series of events, processes and activities begins, leading to contract award. It is very important that you know what occurs before contract award because several key program office actions will occur during this time, ultimately affecting the team and the ISD process.

Purpose

The purpose of this chapter is to explain the major tasks that occur during pre-award of a training system contract and to focus on the contractor and government responsibilities, along with the ISD implications.

Where to read about it

This chapter contains four sections.

Special considerations

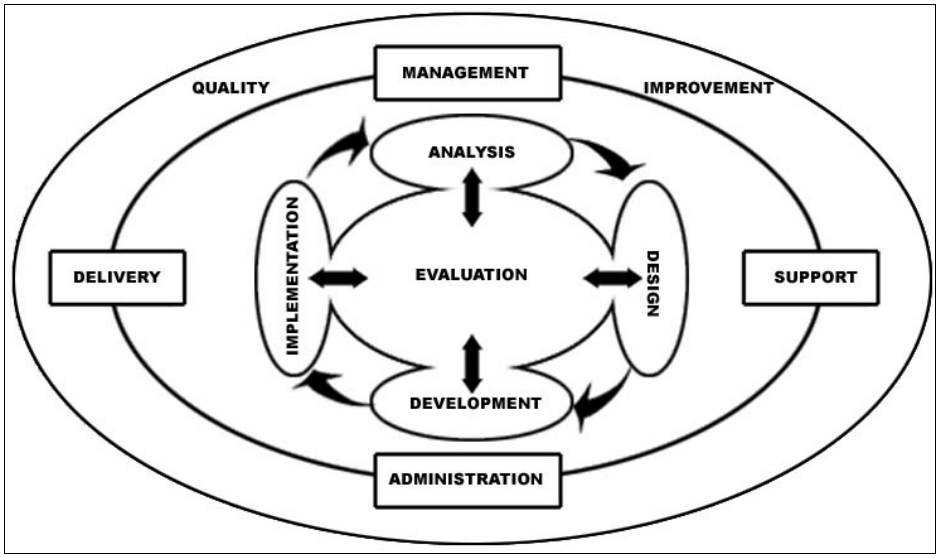
As mentioned above, there will be occasions when it is best for the Air Force to develop its own training. One area that needs special consideration is Air Force developed maintenance training. Another key consideration is interactive courseware (ICW). There will be occasions where you will need to acquire ICW. Because of their importance, these two areas are covered in separate chapters as listed:

Chapter Title	Page
Air Force-Developed Maintenance Training	145
Interactive Courseware (ICW)	159

ISD phase

At this stage, you are conducting planning, preceding the analysis phase of ISD. The updated Air Force ISD model is shown in Figure 8.

Figure 8 Updated ISD Model



Tasking

Throughout the rest of this handbook, various tasks and responsibilities will be described. They will normally be listed as either "Contractor Tasks" or "Air Force Tasks." Never assume that task listings are complete. As you learned earlier, each defense program varies depending on such things as funds, scope and time. Also, note that while all USAF tasks are listed as "Air Force Tasks," they could be performed by different agencies of the USAF, again depending on the program. For example, Air Education and Training Command (AETC) may have various tasks and other responsibilities at different stages in the ISD and acquisition phases. These requirements should be specified and agreed to in a Memorandum of Agreement (MOA) signed by the using command, program office and AETC.

Section A
Acquisition Planning

Introduction

A training system concept has been published that describes the desired overall training philosophy, principles and capabilities. At this point, the Air Force has decided that it will pursue a training contract and now must take steps to prepare and award a contract. Acquisition planning is where considerable communication, assessments, strategy sessions and preliminary planning will take place.

Purpose

The purpose of acquisition planning is to develop preliminary concepts, plans and strategies for the acquisition. By completing this task, the Air Force will be assured that the acquisition strategy is best suited to the purpose, meets user needs, meets regulations and other constraints, and ideally "covers all the bases."

Acquisition life cycle

Before going any further, look again at the diagram of the acquisition life cycle milestones and phases (Figure 9). Acquisition planning is accomplished at each phase. The more defined the defense system becomes, the closer ISD activities can come to actual training system design. The ISD analysis phase is typically part of acquisition planning for Phase I and is repeated again for Phase II. Although training systems are considerations in Phase 0, little ISD analysis is done before Phase I.

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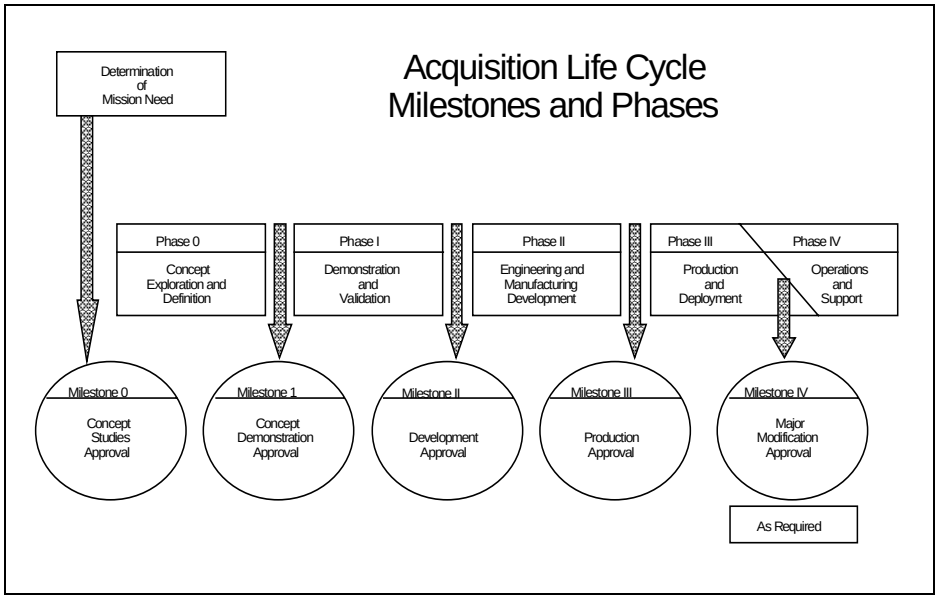
Acquisition life cycle (Continued)

Figure 9 System Acquisition Life Cycle



Contractor tasks

During acquisition planning, the potential contractors are doing everything possible to learn about the potential contract. This includes, but is not limited to:

- Marketing capabilities to using command(s) and program office
- Gathering intelligence data such as:
  - Funding profile
  - Users' perceived requirements
  - Program office's perceived requirements
  - Political advantages and constraints
  - Potential follow-on work
- Identifying strengths and weaknesses
- Evaluating teaming trade-offs
- Evaluating profit potential
- Evaluating cost/schedule/performance risks
- Listing pros/cons of bid/no bid decision
- Responding to Requests for Information (RFI) and Searches for Information (SFI)

Air Force tasks

At this point, the using command will ensure that the SME support principles are agreed to by all levels. While the potential contractors are gathering data and going through their various actions, the program office is becoming very busy in getting this potential program moving. Some actions that they are taking include:

- Engage the using command.
  - Trigger update of training system concept.
  - Get user to define system functional requirements (management, administration, support, delivery of instruction, ISD, QI).

- Engage industry by issuing SFI.
- Perform preliminary program risk assessment.
- Write training system life cycle master plan (top-level system management strategy).
- Engage Program Element Monitor (PEM).
  - Negotiate program-funding profile.
  - Define test agency responsibilities.
  - Identify major program constraints.
  - Negotiate Program Management Document (PMD).

- Assess development risk.
- Define acquisition strategy.
  - Identify alternative acquisition strategies.
  - Examine feasibility of a phased approach.
  - Define Training System Requirements Analysis (TSRA) requirements.
  - If any, which TSRA tasks?
  - Should there be a separate TSRA contract?
  - Lock in strategy at this point.
  - Write acquisition plan.

- Write baseline concept description supporting integrated weapon system management.
  - Establish SME support principles.

Continued on next page

Air Force tasks (Continued)

Having been involved up-front with the TPT, AETC could (if agreed to in Memorandum of Agreement):

- Develop and coordinate AETC participation plan.
  - Specify methodology:
    - Training development or quality assessment
    - Training assessment during Operational Test and Evaluation (OT&E) (AETC will assess whether the maintenance program meets user needs)
  - Specify personnel and other resources.
  - List data requirements.

- Review listing of data items to be considered when a new Air Force training program or course is to be developed under contract.
  - Review MIL-STD-1388-2A and -2B for Logistics Support Analysis (LSA) data requirements.

Military standards

You read that AETC is reviewing military standards (MIL-STD). MIL-STDs are documents issued within the Department of Defense (DoD) in accordance with the basic policy of the Defense Standardization Program (MIL-STD-962). MIL-STDs establish engineering and technical requirements for items, equipment, processes, procedures, practices and methods that have been adopted as standards. MIL-HDBK-29612 is for military training programs.

MIL-HDBK-29612

Since MIL-HDBK-29612 is limited in scope, you need to refer to Attachment C to understand the cross-walk for total training systems acquisition (AFMC/ASC process) and MIL-HDBK-29612. The ultimate goal of MIL-HDBK-29612 is to enable the Government to identify more accurately the data or information that the Government must have to fulfill a training requirement. Because the standard has been prepared for joint service use, understanding how to tailor the task descriptions and data requirements cited in MIL-HDBK-29612 is critical. Failure to tailor accurately and intelligently will result in performance of tasks and purchase of data that either extend significantly beyond the minimum scope of the original training requirement or do not meet the needs of the end user, while unnecessarily escalating

Continued on next page

MIL-HDBK-29612 (Continued)	the cost. The contracting activity and training activity must work as a team to tailor the tasks and Data Item Descriptions (DID) cited in this standard to meet Service-specific needs.
Agreements	During this period, a MOA may be developed between the user and the SPO defining subject matter expert support.
Data	The SPO should have completed the acquisition plan detailing the parameters of the acquisition. Data plans may indicate a need to use consolidated DIDs or use a one-time DID written specifically for the program. You can contact your training engineering support office for assistance in tailoring the RFP to meet your acquisition strategy.

Section B
Request for Proposal Development

Introduction

Initial planning for contract development has been completed and revisions will be ongoing based on training system concept updates, training system life cycle master plan, risk and strategy documents. The Request for Proposal (RFP) must now be developed.

What it is

The RFP is an acquisition package soliciting design and development proposals for new or updated systems from contractors. The document generally consists of:

Executive summary
Instructions to offerers
Requirements documents
Statement of work
Contract Data Requirements List (CDRL)
Model contract
Other special items

The release of the RFP is the official start of the contracting process.

Contractor tasks

During this stage, the potential contractors are continuing their intelligence gathering operations and trying to "scope out" the potential contract as much as possible. They have now begun to talk with SPO personnel concerning:

Specific requirements
"Show stoppers"
Government prejudices or peculiarities

Note: Sometimes the Air Force will issue a draft RFP to potential contractors to get them more in line with the acquisition strategy and to give the contractors an opportunity to give feedback to the Air Force. The draft RFP is not binding in any manner. A second draft release before final RFP clarifies any misunderstandings before going into source selection rules.

Continued on next page

Contractor tasks (Continued)

If a draft RFP has been received, the potential contractors will:

- Review and comment on the RFP.
- Attempt to influence Government (not to give them the contract, but to make various changes to the specifications such as to improve performance, cost, and quality).
- Negotiate potential teaming agreements.
- Generate preliminary system design.

Air Force tasks

The program office is now busy writing various documents specifying system functional requirements, reflecting the user's requirements and constraints. These include:

- System Requirements Document (SRD)
- Statement of work inputs
- Instructions to offerers
- Requirements correlation matrix

In addition, Acquisition Strategy Panel (ASP) decisions affecting the Training System Requirements Analysis (TSRA) are documented. These include:

- Reasons for doing TSRA
- How results precede and feed subsequent program phases
- Rationale for separate TSRA contract or pursuit of phased program

If tasked, AETC will also develop a "strawman" concept of system life cycle training using their experience and familiarity with similar systems. For example, the "strawman" concept of life cycle training will include AETC's estimate of:

- Training requirements for the life cycle of the defense system
- Recommended training methods and media
- Anticipated levels of the training needed by the workforce
- Specific Air Force specialties needing training
- Career point at which the training will likely be required

Continued on next page

Air Force tasks (Continued)

This "strawman" training concept will be used as a baseline for comparison of the contractor proposals. In many respects the "strawman" concepts cover many of the same areas that would be covered in the early development stages of a system-training plan.

AETC could also review the draft RFP for concerns such as the following:

Requirements:

Are overall data requirements adequate?
Is the contractor required to warrant data for accuracy and completeness?
Have Government Furnished Property (GFP) and Government Furnished Equipment (GFE) been clearly identified?
Are requirements for government quality assurance included?
If Computer-Based Instruction (CBI) is required, has it been considered as an acquisition?

Other Considerations:

Are milestones related to the defense system events rather than calendar dates?
Have availability and supportability of GFP/GFE been planned?
Have technical data requirements been included?
Is digitized data or Computer-Aided Acquisition Logistics Support (CALS) considered?
Have facilities and classrooms been considered? (Facilities must be considered up front as part of the acquisition.)

Section C
Proposal Writing

Introduction

A lot of work has gone into acquisition planning and RFP development to produce a draft RFP. Now the RFP will be refined, rewritten in final form and distributed, and potential contractors will write and submit proposals. The contractor will go through many steps to ensure that the proposal is the best document possible, reflects the contractor's capabilities, and is at a fair, competitive price. To write the proposal, the contractor must ensure that several actions are done.

Note: Before the final RFP is delivered to the potential contractors, the SPO and using commands will sponsor bidders' conferences to review the draft RFP and conduct question and answer sessions. Once this is completed and draft RFP shortfalls are remedied, the formal RFP is delivered. A second draft RFP ensures that remedies are satisfactory before final RFP release.

Purpose

The purpose of proposal writing is for industry to prepare a document for the Air Force. The document should convince the AF contracting officer that the contractor's company can produce the best quality product that meets or exceeds the minimum requirements, within specifications, at a fair price, and will be delivered on time.

Contractor tasks

In the proposal, the contractor must show an understanding of the requirements and the intent to comply. The contractor must also include a top-level training system specification showing allocated functional requirements. Source data requirements and tasks must be identified to include:

Identification of associate contractor agreements
Identification of simulator data integrity standards

Continued on next page

Contractor tasks (Continued)

The first major product that the potential contractor prepares is the top-level System Engineering Management Plan (SEMP). This includes plans for development of:

Hardware
Software
Courseware
Firmware

In addition, the contractor will prepare the System Engineering Master Schedule (SEMS), write training system specifications, and identify source data requirements.

Air Force tasks

The SPO will conduct bidders' conferences, discussing draft proposals with the contractor. The SPO will write evaluation standards and identify the source selection team. The using commands and AETC will support the SPO at the bidders' conferences as required.

Section D
Source Selection

Synopsis

At this stage, the Air Force will review all proposals using guidance developed by the SPO. The using commands and AETC should participate in this process. During this process, the Air Force will try to determine the contractor's understanding of the total system functional integration. The using commands will ensure that the training concepts are understood and represent users' interests.

Air Force tasks

Source selection will follow a predetermined and documented schedule of activities. The SPO, working with the using command and AETC, will review many areas. Some questions they may ask include the following.

Feasibility

Can the contractor really do what is proposed in a quality fashion within schedule and budget?

Conformance

Does the proposal meet requirements of the RFP?

Coverage of User Requirements

Will this training satisfy the customer?
Is it what the customer "ordered?"

Consistency

Is planned training consistent with defense system operation and maintenance concepts?

The SPO will also conduct a training system capability and capacity review, if appropriate.

Contract award

After all the above actions are completed and preview steps satisfied, a contract is awarded. Once the contract is awarded, considerable work will begin using the ISD process.

Chapter 4
PLANNING

Overview

Introduction

While reading about the total training system earlier (page 15), you learned that a key ingredient to success is planning. Planning in defense system acquisition consists of many tasks that occur early in the acquisition cycle and continue throughout all phases.

Purpose

The purpose of this chapter is to explain the major tasks in performing planning. While you will not become a planning expert by reading this chapter, you will know the concepts and processes necessary for success.

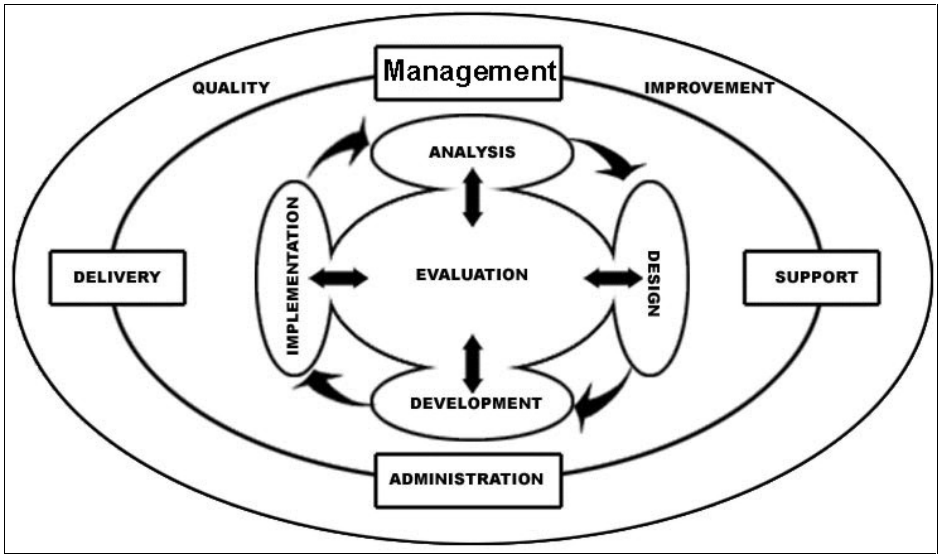
Where to read about it

This chapter contains three sections.

Which ISD phase?

You have not yet entered an ISD phase but are doing preliminary work. You are still in a planning stage, focusing on training while in the management function. This function is highlighted in Figure 10.

Figure 10 Updated ISD Model



Contractor tasks

Since the defense system contractor has been contracted to produce and deliver a system, that contractor plays a large role in planning for training. The contractor is responsible for conducting all the steps in planning while coordinating with the program office and primary operating commands. The acquisition contract may be for courseware or devices, on-site training, type 1 training, or a total training system. (For information about type 1 training, see AFI 36-2201.)

Air Force tasks

Throughout the planning stage, the program office will review all contractor products and design decisions, working with the contractor informally to make required changes, while elevating areas of concern.

The primary operating command supports the contractor with SME advisors from staff, line and supporting positions; they advise regarding training doctrine and provide the practical field experience.

Air Education and Training Command provides support, as requested, by reviewing contractor products and elevating concerns. Specific areas of interest to AETC are discussed later in this chapter.

Section A
Assess Instructional Needs

Introduction

Instructional need has been defined many ways but is generally considered to be the discrepancy or gap between desired performance and current performance. In the acquisition business, it is defined as the process of identifying the problem, documenting any shortfall and developing a solution.

An instructional need exists when an employee lacks the necessary knowledge, skills or attitudes to perform a required

Purpose

The purpose of assessing instructional needs is to validate a need for training in a defense system acquisition.

Stages of assessing instructional needs

The three basic stages of assessing instructional needs are:

Define the problem.
Document the deficiency.
Develop the solution.

Basic steps of analysis

The three overall stages can be broken down into six or more basic steps. You can modify these as necessary.

Step	Analysis Activity
1	**Define the Objectives**. Why are you doing the analysis? What is your goal?
2	**Identify Data Requirements**. What kind of data will you need to review to conduct the analysis?
3	**Select Methods of Gathering Data**. How will you obtain the data you need? Examples are: • Use questionnaires. • Make observations. • Conduct interviews. • Review records/reports. • Analyze work samples. • Conduct tests.
4	**Gather Data**. Obtain, organize and catalog data.
5	**Conduct Analysis of Data**. How does this data compare with skills required? Is your data accurate? Should you double check and verify?
6	**Prepare Reports**. What reports are required? Where do you submit them? Is any follow-up required? Did you meet your objectives? What kind of training is required?

Section B
Develop Overall Outline

Introduction

At this point in the planning phase, you have assessed instructional needs and determined that there will be a training requirement for the product that you are acquiring. But you have also found out that this "product" will create a lot of unknowns in the training and support areas if you don't get a handle on it now. For these reasons, you need to develop an overall outline.

What it is

An **overall outline** is defined as a macro, rough profile of what's going on and what needs to be done. This outline gives the "big picture" of the entire training system.

Structure

There is no required structure to the outline. It will vary depending on the size and complexity of the system being acquired and the training required.

How to develop an outline

The best way to start in developing the outline is to review the contract and the SOW. Developing the outline is similar to developing a Work Breakdown Structure (WBS). A WBS is a hierarchical ordering of work activities and products which is used in detailed planning of work activity units and in costing for proposals and contracts. Your outline need not be as detailed as a WBS, but the areas to consider are similar. Begin with the training system at the top. Next, list broad categories of things that comprise the system. Then consider each of these things and list the activities that go into them. Continue this "pyramid building" until the desired level of detail is reached.

What to consider

Items to consider could include, but are not limited to:

Objective:

Training equipment
Courseware
Trained personnel requirements

Continued on next page

What to consider (Continued)

Support equipment
Training sites
Facilities
Use of operational aircraft/equipment
Aircraft data/parts

Subjective:

Instructors
Defense system schedules
Test plans
Desired instructional approach

Other conditions

When developing the outline, consider how the components of the training system interrelate with each other and the defense system. Progress, delays or changes in the defense system will have an effect on the training system and vice versa.

Section C
Define Planning Requirements

Introduction

Now that you have an outline of the "big picture," you need to define planning requirements. The training development process may require more than one plan. But don't let this scare you away. If done correctly, the selected plans will follow an orderly process and will fit into the overall picture like pieces of a puzzle. A "plan" can be a one-page document or a 200-page binder. It depends on the system, the program and the subject.

Where to start

In defining planning requirements, the first question to ask is: *"What plans will be required?"*

Questions to answer

If you can answer the question above, you are on the right track. If you cannot, then further study may be necessary. Find the answers to questions such as:

What activities need advance preparation?
What do you need to know and have in place in order to do these activities?
Is this information needed for the training system implementation plan?
Is this information needed for the System Engineering Management Plan (SEMP)?
Will there be a courseware/ISD development plan to guide your process?
How will you know the training system quality?
Will you need a test and evaluation plan?

Who develops plans?

After answering the above questions, you can concentrate on the required plans. You need to remember that no single person develops all plans. In a major acquisition, there will be several personnel or several teams of Air Force and contractor personnel developing plans at any given time.

Remember to coordinate and communicate.

Example plans

You touched on some plans that may be important. Some plans you may see are:

System training plan
Training system implementation plan
SEMP
Courseware/ISD development plan
Training system test and evaluation plan
ISD management plan

Air Force tasks

During and following the planning phase, the following actions will occur. The SPO will:

Review all contractor products and design decisions.
Work with the contractor to effect required changes.
Elevate areas of concern.

The using command will:

Provide SME support as required. (SMEs could be utilized from all applicable positions, such as staff, line and support positions.)

AETC will review the ISD management plan to ensure that:

ISD methodology provides for sound, objective, systematic, and traceable training decisions.
Contractor-planned training meets user-defined requirements.

AETC will also identify areas for comparative analysis.

Data

The contractor may deliver the various plans in accordance with the contract, but plans will normally be delivered following the planning stage. This will include the ISD management plan and the training system implementation plan.

Metrics

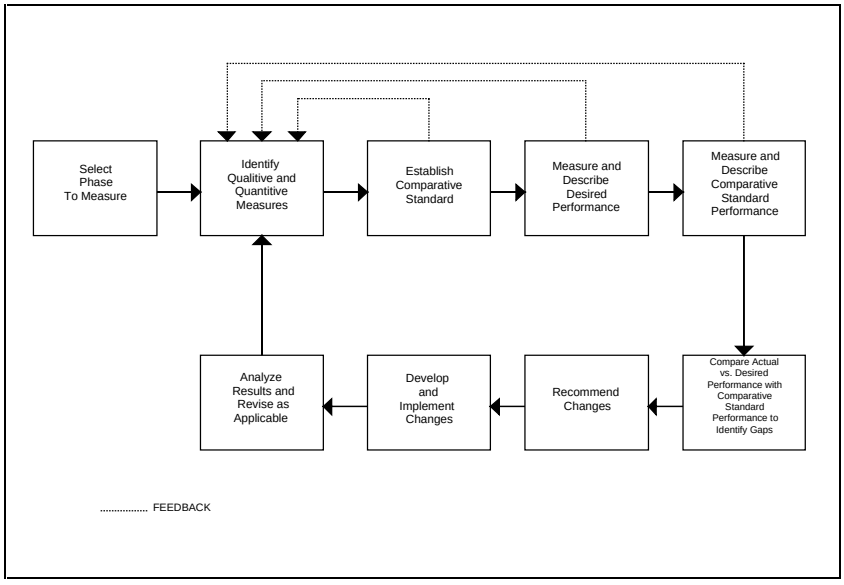
Metrics are standards of measurement or quality indicators that are critical in the acquisition and ISD processes. The purpose of metrics is to give qualitative and quantitative evaluations of processes and products throughout the development of courseware. Acquisition metrics track key factors such as cost, schedule, and performance. Types of metrics include:

- Qualitative
  - Quality assurance
  - Evaluation criteria
  - Subject matter expert review
  - Quality control
  - Traceability
  - Format guide
- Quantitative
  - Personnel/skill allocation
  - Schedule
  - Tracking by lesson
  - Action items
  - Test and evaluation data

Instructional systems metrics overview

Figure 11 represents a typical metrics development and measurement process. You may modify it as necessary to fit your needs.

Figure 11 Instructional Systems Metrics Process



Metrics in this handbook

To assist you in your qualitative and quantitative evaluations, some metrics information is provided throughout this handbook at appropriate places. The first application of metrics applies here, following completion of various planning activities.

Metrics in planning

Earlier in this chapter, you were advised of the Air Force tasks. In completing these tasks, the Air Force needs to consider performing the following activities:

- Review all TSRA deliverables incrementally as drafts are written.
- Compare percentage of completion of draft products vs. completion timeline/milestones.
- Evaluate percentage/amount and types of personnel proposed for each development phase vs. AF experience base. Has the contractor budgeted personnel for the corrections required following individual tryouts?

Chapter 5
ANALYSIS

Overview

Introduction

You should now have available the system training plan or the ISD management plan.

In analysis, the Air Force conducts assessments or monitors instructional designers as they conduct various analyses such as mission analysis, task analysis, and media analysis.

Purpose

The purpose of this chapter is to describe:

- Types of analyses and when they should be conducted
- Related plan updates

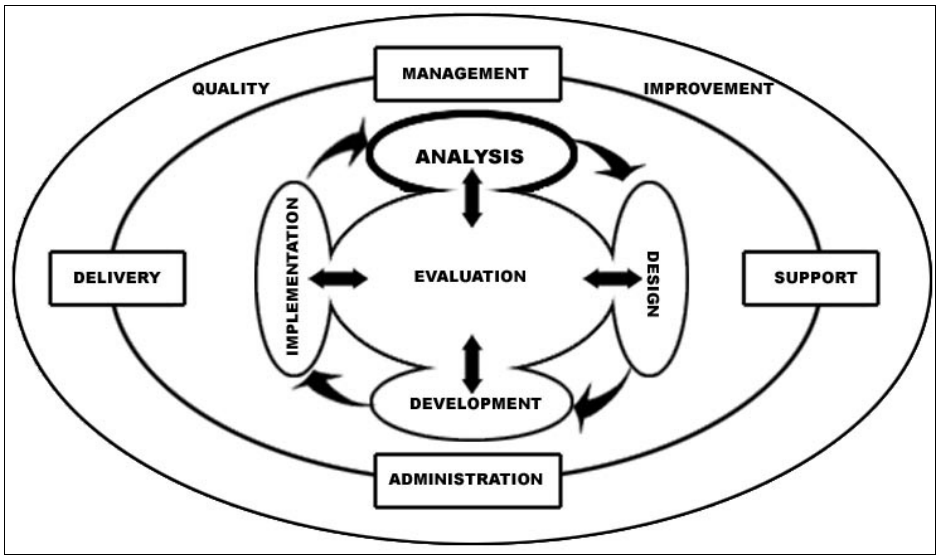
Where to read about it

This chapter contains eight sections.

ISD phase

You are now in the analysis phase. An ISD model, with the analysis phase highlighted, is provided in Figure 12.

Figure 12 Analysis Phase



Section A
Mission Analysis

Introduction

Mission analysis and task analysis normally go hand-in-hand. Mission analysis generally precedes task analysis. A mission analysis will provide basic data on system functions, types of equipment, maintenance requirements, educational goals and other information.

What it is

Mission Analysis is defined as a process of reviewing mission requirements, developing collective task statements, and arranging the collective tasks in a hierarchical relationship.

Contractor tasks

Many tasks are conducted during a mission analysis. Some tasks will occur concurrently, others subsequently. These tasks can include the following:

Collect mission data.
Perform literature search.
Conduct interviews.
Conduct on-site visits/reviews.
Compare new system to existing system.
Compare new system to similar system.
Document mission descriptions.
Create traceability database.

Air Force tasks

During this stage, the SPO will continue dialogue with the contractor, reviewing products and giving guidance as necessary. As delegated, the user and AETC will review contractor deliverables for validity, process conformance, technical accuracy and completeness.

Data

A report is due at the completion of task analysis, which is discussed in the next section.

Section B
Task Analysis

Introduction

Every job in the Air Force consists of tasks that comprise the job. The goal of task analysis is to zero in on the target population or the group needing to be trained and determine what they need in order to do the job.

What it is

The best way to define task analysis is to break it down into two parts.

Job Task Analysis - A process of examining a specific job to identify all the duties and tasks that are performed by the job incumbent at a given skill level.
Training Task Analysis - The process of examining each unique unit of work from the job task analysis to derive descriptive information used in the design, development, and testing of training products.

Contractor tasks

Task analysis is a more in-depth analysis compared to mission analysis. It is a further breakout, narrowing the analysis to the required tasks. It includes the following activities:

Identify tasks for each mission.
Describe critical functions.
Generate task lists based on defense system crew composition.
Document crewmember qualification levels.
Create preliminary task hierarchical list.
Document expected performance required for each task.
Trace tasks back to mission descriptions (using database).

Air Force tasks

The SPO will continue dialogue with the contractor, reviewing products and giving guidance as necessary. The SPO will review and approve the reports as appropriate. They will review the reports for accuracy, ensure that task lists are complete, and verify that correct "assumptions" were made. The SMEs will evaluate draft deliverables from the perspective of the using command requirements.

Continued on next page

Air Force tasks (Continued)

Training analysts review for compliance with DIDs and required processes. They will also review to ensure that traceability has been maintained throughout the Training System Requirements Analysis process (as discussed in Chapter 2).

Data

Following completion of mission and task analysis, a report is required. The report should contain items such as:

Mission Items:

- Objective
- Scenario
- Segments
- Profile
- Map descriptions

Other items:

- Graph descriptions
- System and operator requirements
- Detailed task analysis
- Task analysis record
- Master task listing

Section C
Training Requirements Analysis

Introduction

When a new or modified defense system is being designed and developed, training impacts must be considered throughout the process. As you know, no system is fully functional without the trained personnel to operate, maintain, and support it. Ideally, the mission and task analyses have been performed or are in a stage of completion. Now the training requirements analysis begins.

Purpose

The purpose of the training requirements analysis is to develop the training task list. These are the tasks for which the student lacks the skills, knowledge, or attitudes in order to perform them.

How is a task list developed?

To develop a task list:

First conduct a target population analysis
Data determines types of students entering the training system and their current skills/knowledge/attitudes

Perform a breakdown of skills, knowledge and attitudes to determine which skills, knowledge and attitudes is performed.
Determining which skills can be trained in what setting.

This breakdown will be a key factor in conducting objectives analysis (Section D).

Who develops it?

The contractor normally develops the analysis with input from SMEs.

Contractor tasks

Conducting early training requirements analysis, including any preliminary analysis during concept development, will help ensure that the following tasks are done.

Assess and analyze:
Assess potential sources of students.
Assess students' knowledge and education.

Continued on next page

Contractor tasks (Continued)

Analyze pertinent data on unique student characteristics to compare with job expectations.
Assess life cycle training and support impact.

Create and Document:

Finalize procedure for defining training requirement.
Create final training task hierarchy list.
Document findings by writing Training Requirements Analysis Report (TRAR).
Document in a database, tracing requirements back to mission descriptions.

Determine:

Identify target population (potential students).
Determine student experience level.
Identify students' current proficiency and qualifications.
Define increase needed in skills, knowledge, and attitudes (SKA).
Define performance factors and qualification levels for terminal objectives.

Air Force tasks

The SPO will review the report, comment and approve, as appropriate. The user will:

Conduct comparative analysis for comparison to contractor-performed analysis results.
Review contractor-training decisions for traceability, completeness, accuracy and reasonableness.
Check that target population definition is correct.
Verify that performance factors reflect valid performance requirements.

Data

Following the above actions, the contractor will deliver the TRAR and other documentation in accordance with the contract.

Metrics

The Air Force will be performing continual risk assessment and comparing:

Technical staffing vs. plan
Differences between planned vs. actual completion
Quality factors for products or processes

Section D
Objectives Analysis

Introduction

Training objectives are the framework in which training systems are designed and developed. The objectives are directed at meeting all training requirements. The achievement of the training objectives makes up the difference in knowledge, skills, and attitudes needed by the target population to do the job.

Purpose

The purpose of conducting objectives analysis is to clearly state training requirements in terms of conditions, standards, and behaviors, and arrange them in a logical and effective sequence. This becomes very important when structuring the course syllabus and developing the courseware.

How is it developed?

There is no "concrete" way to organize training objectives. Objectives are organized in the most effective and efficient way to conduct training. There are several recommended tasks in an objectives analysis.

Who develops it?

The training system requirements analysis contractor performs the objectives analysis with input from SMEs.

Contractor tasks

The contractor will complete many tasks at this stage, including:

- Develop objectives, including:
  - Top Level
    - Terminal
    - Primary
  - Lower Level
    - Enabling
    - Secondary
    - Supporting
    - Subordinate
    - Developmental

Continued on next page

Contractor tasks (Continued)

Translate training requirements into objectives for each qualification level reflecting:
- Behavior
- Conditions
- Standards

Document objectives hierarchy.
Using database, trace objectives back to mission descriptions.
Sort/organize objectives into hierarchy for each crewmember position.
Create flow chart for subordinate/superordinate relationships.
Describe qualification levels.
Document analysis.

Air Force tasks

The SPO will:

Review rationale, justification, and traceability of the training objectives hierarchy.
Continue working with the contractor, giving guidance as required.
Review and approve any objectives and media reports.
Through SMEs, review and coordinate the training objectives hierarchy, as well as the task analysis process.

Data

The contractor will deliver documentation in accordance with the contract. This will probably not occur until completion of media analysis, which is described in the next section.

Section E
Media Analysis

Introduction

Instructional media refers to the different means used to give information to the student. Different types of media have various levels of effectiveness, depending on the complexity of the subject being taught. Media analyses must be conducted to ensure that the most effective media are used to efficiently meet the training requirements.

What it is

Definitions of media vary, but for purposes of this section, **media** refers to a channel of communication utilized to aid learning. Types of media vary from instructor-based to full mission simulation.

Media analysis is defined as the process of examining media requirements and assembling a data bank of information to use for selecting appropriate media for use in instruction.

How is it developed?

Media analysis is not a straightforward process. It is an iterative process with various media tradeoffs made prior to determining the media pool. The media pool is the agreed-upon set from which media will be selected. The "preferred" media are selected and scrutinized against possible tradeoffs such as cost, logistics, maintenance support and facilities. Consistency of media is also an important consideration. The goal is an optimal media solution that is feasible to implement within the training system design.

Who develops it?

The contractor conducts media analysis, with some input from SMEs. The contractor normally uses training analysts and systems engineers in the effort.

Contractor tasks

Media analysis can be a very detailed process and will vary depending on the program. The contractor will complete tasks such as the following:

Conduct surveys of:
- Instructional systems
- Educational technologies
- Authoring systems

Define student evaluation techniques.
Select media allocation model (if applicable).
Conduct media trade study.
Analyze media training effectiveness.
Allocate candidate media in matrix.
Using database, trace media allocations back to mission descriptions.
Analyze instructional strategy alternatives.
Develop global instructional strategy.
Identify levels of courseware required for computer-based training (CBT).
Document analysis.

Air Force tasks

The SPO has continued dialogue and guidance with the contractor. The SPO will ensure that documentation meets requirements. They will again ensure that objectives are traceable to and support valid training requirements. They will also check for:

Logical objective grouping.
Correct objective flow.
Verification that all training requirements are covered by objectives.
Appropriate media selections for skills taught (with special attention to use of operational aircraft and hardware).
Validity of functional and physical fidelity requirements.
Validity of media selections and training requirements.
Assurance that operational equipment is considered in media analysis.
Assurance that AF technical training centers equipment and media needs are addressed.
Assurance that if CBT is selected as media, it is procured as part of the acquisition.

Steps to media selection

The above list can be summarized in the following steps to select media.

Develop a list of possible media.
Review constraints relative to cost, time, availability, resources, etc.
Evaluate media needs relative to content, objectives, instructional strategies, teaching methods, and organizational patterns.
Verify that media are compatible with other AF systems and standards.
Eliminate media not matching your needs.
Verify/revise remaining media options.
Select the best media match.

Foolproof? Absolutely not! The choice is yours and the parameters depend on the contract and course objectives.

Data

A training media analysis report will be delivered in accordance with the contract.

Section F
Cost Analysis

Introduction

To make intelligent decisions about the selection of a system to fulfill a specific need, you must look beyond the immediate cost of developing and producing that system. You must look at various alternatives in training approaches. You learned earlier about media analysis and various factors you must consider. Closely interrelated with that is cost analysis. In cost analysis, you analyze not only instructional media but also life cycle costs such as operations, maintenance and support. A system that is initially more expensive may be less expensive in the long term. But the reverse tends to be true. Also, the cheapest up-front system generates more support costs and sometimes even more remedial and follow-on training costs.

Purpose

The reason you must conduct cost analysis is to make sure you are acquiring the best long-term value by performing a comparative evaluation of potential instruction methods and media to determine the most efficient alternative.

What it is

You learned earlier that the types of media are defined as the delivery vehicles for presenting instructional material to students to induce learning.

Additionally, **training effectiveness analysis** is defined as the process of measuring and integrating the training effectiveness and the cost effectiveness of existing and/or proposed alternative training system configurations and components in order to determine the optimal mix of new training system components, or to evaluate and improve existing training systems. In other words, to determine the most effective training for the money available.

Training strategy is defined as the logical arrangement of course content within a pattern or organization, which will likely cause the most learning to occur. It includes the purpose, target audience, content outline, interaction, feedback, testing, audiovisual options, and other data.

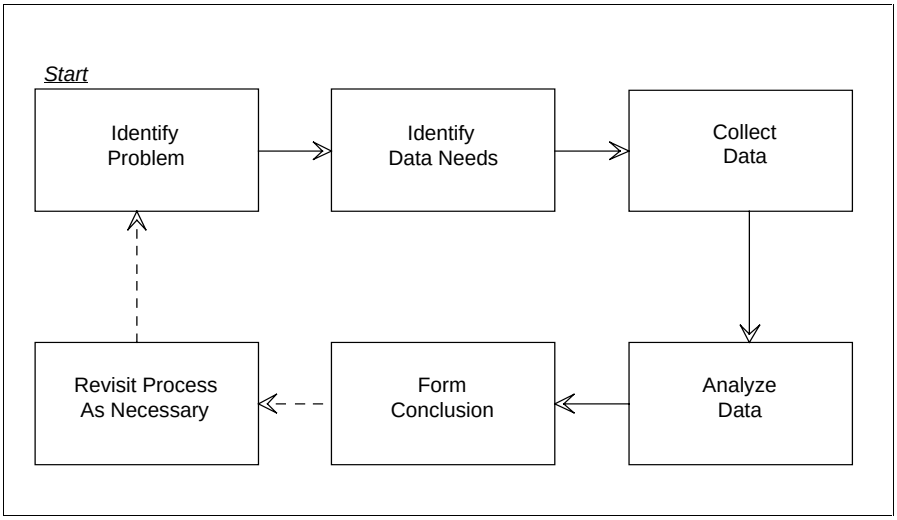
Background

Your goal should be to determine the most effective and efficient training possible. There are alternatives for nearly all training strategies. You may not want to use alternatives, but funding or scheduling may force you to. The best-planned training strategies sometimes are changed due to design, schedule or other modifications. That is why you must analyze life cycle costs compared to training strategy alternatives. It is always better to be prepared up front.

How to prepare cost analysis

Depending on the training system program being worked, cost analysis could be performed in a manual mode or by utilizing automated cost analysis models. Cost analysis can be a time-consuming process that, if done properly, will pay long-term dividends. Figure 13 is a simplification of what is involved in cost analysis.

Figure 13 Cost Analysis



What is included?

The first step in the process is to identify the problem. The word "problem" may be a misnomer in that what you really have at this point is a "challenge." Your challenge is: "Do we use classroom instruction or CBT, videotape, or ICW? Or do we use a simulator or actual operational hardware? What is the student load?" Once you identify the problems, you must identify what data will be needed, how to collect the data, and so on. These steps can be modified and expanded as necessary to support the task at hand.

Final report

When you have finished the process, you will have developed a cost analysis report that identifies the best strategy to take to utilize the most efficient and effective training available.

Contractor tasks

The contractor will analyze life cycle costs versus:

Training effectiveness
Media alternatives
Training strategy alternatives

They will also document cost analysis in the training system basis analysis report.

Air Force tasks

Following completion of the cost analysis, the SPO continues dialogue and guidance with the contractor. They will review cost analysis documents to ensure that:

Comparisons are appropriate.
Trade-offs are properly considered and analyzed.
Analyses are unbiased.
Factors used are complete, appropriate and realistic.

Section G
Training System Basis Analysis

Introduction

In the planing phase of ISD, you developed a "big picture" outline of instructional needs and potentially required plans. You identified what plans would probably be required and identified elements of the training system implementation plan. Among other things, you decided if there would be a courseware/ISD development plan. The training system basis analysis (TSBA) is one of the activities in this phase.

Purpose

The purpose of the TSBA is to develop the training system concept and define the training system configuration. The TSBA report documents existing training programs and establishes the functional baseline for the design, development, and operation of an integrated training system. The report is used to define training capabilities and establish system requirements for the training system.

Contractor tasks

The contractor will review and update previous work in planning and analysis to complete the following requirements.

New Items:

Write development plans for the instructional system and for courseware.
Define training system conduct.
Assess training technologies (incorporate media analysis from objectives and media analysis).
Perform problem analysis.
Develop success criteria for:
- Course Readiness Review (CRR).
- Site Readiness Review (SRR).
- Training System Readiness Review (TSRR).
- Using database, trace system requirements back to mission descriptions.
- Validate requirements analysis database traceability.

Continued on next page

Contractor tasks (Continued)

Continuing items:

Update training system implementation plan.
Document existing training system.
Document similar training system.
Document inputs for System Requirements Document (SRD).
Document analysis.

Air Force tasks

The SPO will continue to work with the contractor throughout this process, and must review contractor intermediate products, elevating any areas of concern. Once the report is delivered, the SPO will review and approve as appropriate. The SPO will also:

Identify any new requirements and changes reflected in top-level program documents such as:
- Using command(s) system training plan(s)
- Operational readiness document
- Previous TSRA products
- Program management directive
- New constraints such as:
  - Cost changes
  - Schedule changes
  - Site changes
  - System changes

Verify that all valid training requirements are covered.
Verify that all system requirements are traceable to valid training requirements.
Check to make sure that if success criteria are met, they will ensure success.

The using command(s) will support the SPO as necessary and will support a MOA for SME use.

Note: If this contract is not a single, total system development, the SPO must:

Write a new RFP.
Write SRD providing a functional description of all requirements for the total training system (single-contract programs only). This includes student input/output.
Estimate SME requirements.
Negotiate MOA with using command(s).

Data

The contractor delivers documentation according to the contract. This documentation, such as a report, may tie together and integrate all previous training system requirements analysis major activities. This report can cover:

- Planning and scheduling considerations
- Analytical process
- Design goals and requirements selection
- TSBA report results such as:
  - Information sources and data collection
  - Existing training system analysis
  - Similar system analysis
  - Training technology assessment
  - Problem analysis

Section H
Preliminary Syllabus

Introduction

Now a preliminary syllabus will be developed. A preliminary syllabus puts into an outline the "big picture" of the training system in a "real world" context.

Purpose

The purpose of the preliminary syllabus is to develop and document a detailed outline of the overall structure of the instruction. The preliminary syllabus will provide a master plan that describes how the training system configuration and overall training concept will be used.

Contractor tasks

Using the previously developed guidance, such as the various plans, analyses, objectives and media analyses, an unrestrained syllabus is developed. This unrestrained document looks at the big picture, covering the entire training system. The goal is to let nothing be overlooked. To develop an unrestrained syllabus, the contractor must:

Cluster/sequence objectives.
Define course structure.
Define course times.
Develop course maps.

Once this is done, constraints must be applied and the target must be narrowed to best fit the objectives. The contractor must:

Update media allocation matrix.
Show course times.
Indicate facility needs.

Once constraints are applied, document the preliminary syllabus while tracing syllabus elements back to mission descriptions. It’s important that a database be used for this to ease reference and tracking in the future.

The final step in this area is to write a comprehensive syllabus report and identify lessons for prototyping.

Air Force tasks

The primary job of the using command at this point is to update the STP. The SMEs will review the preliminary syllabus to ensure that their objectives are part of the syllabus.

As the contractor develops preliminary syllabus documents, the program office reviews the products, giving guidance as necessary. The final step for the SPO is to review and approve the preliminary syllabus.

AETC will review the preliminary syllabus for:

Logical flow
Coverage of all valid training requirements

Data

A syllabus development report is delivered as required by the contract.

Chapter 6
DESIGN

Overview

Introduction

You are now proceeding into the design phase of ISD. This is a good time to remember that you should never consider that the planning and analysis phases are over

The various phases of ISD are never complete.

While you may go progressively from one phase to the next, you will periodically revisit a phase to update a plan, add something you overlooked, or make mid-course corrections. As mentioned in Chapter 1:

ISD is flexible and is not a step-by-step linear process.

But, now that you have developed plans and conducted various analyses, it is time to start designing instruction.

Purpose

The purpose of this chapter is to describe the ISD design phase and the various applications that are specific to acquisition of a defense system.

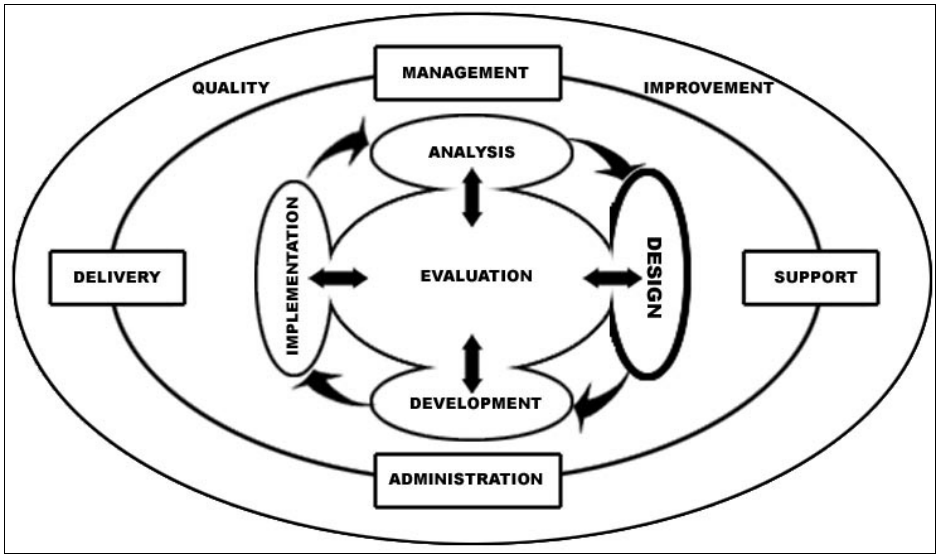
Where to read about it

This chapter contains five sections.

ISD phase

Now you are at the design phase. This phase is highlighted in Figure 14.

Figure 14 Design Phase



Section A
Start of Development

Introduction

This section is included to cover the situations where a Training System Requirements Analysis (TSRA) is not done, or was done by a separate contractor. If the prior TSRA was conducted as part of a single contract, you can skip this section if that contract allows the contractor to proceed into development.

Note: Although you are in the design phase, some development actions take place.

Contractor tasks

As mentioned, if prior tasks were performed as part of a single contract for total system development, nothing happens at this stage. But if prior tasks were performed as part of a stand-alone TSRA or of a multi-phased development, the contractor uses the TSRA results and prepares a proposal.

The contractor will write a new system specification as part of the proposal.

Air Force tasks

If prior tasks were performed as part of a single contract for total system development, nothing happens here.

If prior tasks were performed as part of a stand-alone TSRA or of a multi-phased development, this is the point of a new solicitation (see note on page 88). The program office will then generate:

New RFP
New SRD (if required)
New source selection
New contract award

If a new RFP is required, the using command will support the source selection actions.

If AETC performs ISD (such as in maintenance training), training equipment functional specifications will be provided to the SPO. The SPO will then develop an RFP from the functional specifications. When the RFP is issued, contractor involvement begins. This RFP kicks off actions previously described beginning on page 54, Request for Proposal Development.

Section B
Guidance Conferences

Introduction

At this point, a contract has been awarded for development of the training system. The Air Force will now schedule guidance conferences (normally two) to assist the contractor.

Purpose

The purpose of the guidance conferences is to ensure that all parties understand and agree on requirements, roles and responsibilities. The goal is to eliminate or minimize misinterpretations and misunderstandings.

Who conducts?

The Air Force will conduct the conferences at the contractor's facility shortly after contract award.

Air Force tasks

The program office will:

Conduct Program Requirements Guidance Conference (PRGC), including the following tasks:

- Review contract.
- Review management issues.
- Review data issues.
- Discuss use of System Engineering Master Schedule (SEMS).

Conduct System Engineering Guidance Conference (SEGC). Discuss contractor's approach to:

- Writing process descriptions
- Organization
- Structured model philosophy
- Software, hardware, courseware management
- Test philosophy
- Working groups establishment

Section C
System-Level Development Plans

Introduction

Previous chapters covered the development of preliminary plans on various subjects such as a Systems Engineering Management Plan (SEMP), while also defining planning requirements in areas such as quality and life cycle operations. Based on these preliminary reviews and using the various plans and analysis stages, detailed system level development plans will now be written.

Purpose

The purpose of these plans is to have "road maps" or guides, listing various goals and procedures to follow. While ISD in itself is not linear, some of the components of ISD must be followed in a linear process for successful goal accomplishment. Plans that are contractual will "direct." Those not contractual will "guide."

Contractor tasks

The main goal of this stage is to get the contractor to write, or in some cases, update, system level development plans. One of the largest plans to be written is the SEMP. The SEMP includes, but is not limited to:

Engineering:

System engineering organization (how hardware, software and course organizations interact)
System engineering detail schedule (how used)
How the work breakdown structure is used by engineering

Security issues:

Planned trade-off studies and analyses
Risk management plan
System security plan
Integration of reliability, safety, environment, etc.

Continued on next page

Contractor tasks (Continued)

Organized input:

- Incorporation of Integrated Logistic Support (ILS)
- Technical Performance Measures (TPM)
- SEMS (how used)

Other Issues:

- Transition to manufacturing
- Training program metrics (processes and products)
- Use of working groups
- Baseline control procedures
- Conduct of design and technical management reviews
- Use of prototypes
- Other information as required

Other plans that may be required, depending on the contract and system, include:

- Software development plan
- Hardware development plan
- Configuration management plan
- Courseware development plan
- Source data management practices:
  - Weapon system data support plan
  - Required data flow across training system
  - Strategy for data holes and deficiencies
  - Associate contractor agreements
- SME roles and responsibilities (system-wide)
- Training System Implementation Plan (TSIP):
  - Transition plan (from previous training system to new system)
  - Life cycle operations and maintenance plan
  - Personnel plans for operations and maintenance
  - Equipment plan:
    - Storage
    - Utilization
    - Maintenance
  - Student grading and evaluation plan
  - Training materials management plan
  - Facilities management plan
  - Instructor and student utilization, training and scheduling plan

Air Force tasks

The SPO will also review for disconnects between contractor plans/schedules and training need dates for:

Developmental Test and Evaluation (DT&E)
Operational Test and Evaluation (OT&E)
Initial cadre
Follow-on training
Initial Operational Capability (IOC)
Required Assets Available (RAA)

The program office will also review for disconnects between:

Facilities plans
Funding plans/levels
Personnel plans/levels
Training dates (do they match required delivery date [RDD]?)

The using command needs to review the revised SME support MOA and support or negotiate it as required.

As the contractor is writing and/or delivering applicable plans, the program office should be conducting a "big picture" review. At this point, the SPO must ensure that the total training system functional requirements and integration are defined for all Configuration Items (CI). Now that plans and workload are becoming more visible, this would be a good time for the SPO to update the MOA defining SME support.

Unless delegated in the MOA, the program office will review contractor plans and compare with:

STP
User training requirements
Defense system acquisition and test plans

Quality plan

While all plans serve a purpose and are important, the quality plan is always critical. It is most important that plans are **written to be used and followed**. "Filling squares" in the plans business will eventually catch up with you, especially in the quality area. The training system quality plan should include items such as:

Training management plan

Training system support center
Training management system

System-level evaluation

Formative
Summative

Section D
Courseware Planning Leading to System Readiness Review

Introduction

Although this is the design phase of ISD, you continue to conduct planning updates, evaluations and quality improvement. There are relatively few cases where you finish one task or phase completely, go to the next, and never have to revisit previous work.

ISD is a continuous process.

Purpose

The purpose of planning is to ensure that the required plans have been considered and are now going to be written. These plans will define and organize various tasks and procedures necessary to design, develop, implement, evaluate and support instruction.

Contractor tasks

Some of the major plans that will be written are the courseware development plans. Because of contractual or system requirements, these plans may be written at an earlier stage. If so, now is the time for updates. Courseware development plans should:

- Define development process.
- Define organization.
- Define handoffs.
- Define controls.
- Address procedure and criteria for:
  - Individual tryouts
  - Small-group tryouts (SGTO):
    - Design reviews
    - PDR/CDR process

These plans should also include:

- Production resources plan and tracking procedures
- Courseware configuration management plan
- Courseware production plan (draft)
- Courseware development schedules (draft)
  - Tie to integrated master schedule

Continued on next page

Contractor tasks (Continued)

Identification of unique courseware aspects of any system level plan

In addition, a test and evaluation plan may be written, which will include:

Formative, summative and operational evaluation plans
Data collection procedures
Using command roles and responsibilities:
- Use of SMEs and ITO/SGTO students

Review criteria:
- Course Readiness Review (CRR)
- Site Training Readiness Review (STRR)
- Training System Readiness Review (TSRR)

Corrective action procedures
Prototype lesson planning
- Completion of prototype lesson selection

Definition of support requirements for development and evaluation
Definition of course review board (CRB)
- Function
- Charter
- Membership

Air Force tasks

As the contractor develops the plans and delivers according to the contract, the SPO must:

Review plans, schedules and criteria.
Work with contractor to effect required changes.
Alleviate areas of concern.

As the SPO reviews various contractor products, the using command representatives will conduct similar reviews. Following their review, written comments will be provided to the SPO.

Continued on next page

Air Force tasks (Continued)

AETC will continue to review contractor plans and products. AETC will also:

Check for continuity with system level plans and STP.
Verify that development plans and schedules allow meeti1ng training need dates.
Validate development process.
Verify that quality plans will help ensure quality.
Prepare for participation in System Readiness Review (SRR):
Concerns
Issues to address

Acquisition milestone

Following the planning update, an SRR is conducted. This review, attended by the SPO and using commands and contractor, is conducted to ensure that all players understand the requirements and are ready to proceed.

Higher system level activities

By the time of the SRR, ensure that the following contractor tasks are done:

Work Breakdown Structure (WBS) is complete.
Cost schedule control system is in place.
Requirements analysis is complete.
Functional baseline is updated.
System level test requirements are defined, including:
System level formative and summative evaluation

The contractor should also:

Update TSRA documents.
Write development plans for training devices.
Finalize configuration management plan at SRR.

Section E
Development Activities

Introduction

Development activities are now beginning as you progress through the ISD design phase. These development activities are segregated into three main groupings to facilitate various actions that must occur. The three groupings are listed below.

Purpose

The purpose of development at this stage is to ensure that all the various required plans, syllabuses, lesson outlines and other documents are written, in place and functioning prior to SDR, PDR, and CDR.

Development Activities Leading to System Design Review (SDR)

Contractor tasks

In the first stage of development activities leading to SDR, the contractor defines the development processes. If a preliminary syllabus was developed earlier, the update or comprehensive syllabus is written now. Along with the comprehensive syllabus, the contractor should:

Define interactive courseware (ICW) production standards:
- Authoring system capability
- Delivery platform capability
- Lesson portability (compliance with DODI 1322.20, Development and Management of ICW for Military Training)
- CBT levels required
- Style guide
- Audiovisual support material standards

Define design formats for:
- Lesson outlines
- Lesson flow diagrams
- Lesson plans (for standup instruction)
- Lesson strategies (lesson specifications for CBT)
- Storyboards for CBT
- Mission scenarios

Draft checklists for success criteria for:
- Course Readiness Review (CRR)
- Site Training Readiness Review (STRR)
- Training System Readiness Review (TSRR)

Write PIDS for all courseware at the course level, including:
- Purpose of course
- What is to be taught
- Required terminal learning objectives
- Media to be used
- CBT level to be used
- Student entry/exit levels
- Test requirements

Continued on next page

Contractor tasks (Continued)

Design prototype lessons, including:

- Lesson outlines
- Flow diagrams
- Lesson strategy
- Storyboards
- Mission scenarios

Air Force tasks

The SPO must review all contractor products and design decisions, working with the contractor to effect any required changes. Areas of concern should be elevated. The SPO should:

- Review and comment on ICW production standards.
- Review and comment on design formats.
- Review and comment on Prime Item Development Specifications (PIDS).

As in the planning update, and for all development activities, the using command will have SMEs review contractor products, providing comments to the SPO.

AETC will review the contractor's documents for proper incorporation of SRR recommendations and compatibility with user requirements and timeliness. They will then prepare for participation in the SDR.

Acquisition milestone

At this point, the system design review is conducted.

Metrics

During the SDR, the AF will review the contractor's responses to action items from the SRR and ask questions such as:

- What is the seriousness of the priority action items?
- What is contractor timeliness of response to action items?
- Are the contractor's updated personnel/skill allocations consistent with the program as defined at SRR?
- Are updated versions of critical planning documents (such as ISD management plan, quality plan, etc.) consistent with SRR decisions?

Continued on next page

Metrics (Continued)

Are course contents planned for each course element and the personnel planned to accomplish it consistently?

Note: Ensure consistency with production tracking device, because the levels you establish here will be used as a baseline for tracking future production resource consumption.

During the SDR, the AF will also:

Verify that the contractor is prepared for the PDR.
Verify that the PDR checklist shows that the contractor meets all requirements for PDR. Pay special attention to the system engineering master schedule. For example, how are they doing compared to schedules?

Higher system level activities

By the time of the SDR, the contractor should have accomplished the following:

Allocated baseline is established across the system.
Second-level specifications are complete, including:
- Configuration Item Development Specifications (CIDS)
- Prime Item Development Specifications (PIDS)

System design is complete.
System-level development plans are updated.

Development Activities Leading to Courseware Preliminary Design Review (PDR)

Contractor tasks

The contractor has written a syllabus, met with the SPO during the SDR, and will now finalize the syllabus, incorporating any changes required. In addition, the contractor will:

Update production standards.

Update design formats.

Update courseware development plans:
- Integrate courseware:
  - Within system (with devices)
  - Within courses
- Courseware test and evaluation:
  - Formative
  - Summative
  - Operational
- Implementation

Continue prototype lesson development.
- Code, program or write.
- Show and tell what is available at PDR.

Update checklists for success criteria for CRR, STRR, and TSRR.

Work with government to assure closeout of prior action items from SRR and SDR.

Air Force tasks

The SPO must review all contractor products and design decisions, working with the contractor to effect any required changes. Areas of concern should be elevated.

The using command will review contractor intermediate products as draft deliverables, providing comments to the SPO.

AETC may review contractor drafts, as well as final products. They will check to make sure that:

- SRR and SDR action items have been incorporated.
- Syllabus covers training requirements and has logical flow.
- Plans reflect known changes in defense system schedules.
- Formative and summative evaluation plans, quality plan, and test plan are logical and coordinated and can reasonably be expected to lead to quality training.

Metrics

During the PDR, the Air Force will verify that the contractor is ready for the PDR.

- Does the PDR checklist show that the contractor meets all the requirements for the PDR, on schedule and in accordance with the SEMS?

Higher system level activities

By the time of the PDR, the contractor should have completed:

- System-level evaluation plan for formative and summative phases
- Hardware and software status reviews at system level
- System-level development plan updates

By the time of the system PDR, the contractor should have completed:

- Top-level functional design
- Top-level software design
- System-level test plan
- Allocated baseline
- Synchronized sub-element schedules

The contractor also has identified the status of all hardware, software, weapon system data, and training system component hardware and software.

Incremental PDRs are conducted across the system for other system components.

Development Activities Leading to Courseware Critical Design Review (CDR)

Contractor tasks

The actual lessons of the course are now being written in draft form. During this stage you will develop lesson outlines and flow charts for all lessons. In addition, you will:

Complete prototype lessons.
Finalize courseware development plans.
Finalize test and evaluation plan for courseware.
Finalize production standards.
Finalize design formats.
Finalize checklists and success criteria.
Finalize production schedule.
Close out all prior action items.

Note: At this point, the contractor is nearly ready for the courseware CDR. To ensure that everything is in order, the contractor should remember that at the CDR the following should be done:

Demonstrate prototype lessons.
Baseline prime item development specification (written at course level).
Review hardware/software/courseware integration.
Nominate members for Curriculum Review Board (CRB).

Air Force tasks

The SPO has a critical task at this point since the CDR represents the final hurdle before entering the ISD development phase. The SPO must now review and approve all contractor products, working with the contractor to effect any required changes. The SPO will:

Review prototype lessons.
Review all development plans.
Review design formats and production standards.
Place PIDS under configuration control of contractor.
Review HW/SW/CW integration of Training Management System (TMS) and Training System Support Center (TSSC).
Review courseware integration with training system design; ensure total system integrity.
Review status of contractor personnel and resources.

Continued on next page

Air Force tasks (Continued)

The using command will review contractor products as draft deliverables, providing comments to the SPO.

AETC will review contractor documents and pay special attention to lesson outlines and flow charts. They will verify that:

There is a logical flow of lessons.
Lessons are traceable to ISD analysis.
Lessons meet training requirements.
Lessons adhere to sound principles of instruction.

AETC will also review the test plan to ensure incorporation of comments and necessary changes from previous draft.

Acquisition milestone

The critical design review for courseware is conducted during this period.

Metrics

The Air Force should verify that the contractor is prepared for the CDR. Review and answer questions such as:

Does CDR checklist show that contractor meets all requirements for CDR in accordance with SEMS?
Do syllabus and PIDS reflect traceability and comprehensive course design?

Higher system level activities

At this stage, the contractor:

Completes designs for system-level HW/SW/CW integration.
System designs integrate:
- TMS
- TSSC

Writes training system implementation plan.
Ensures that all PIDS are authenticated.
Participates in incremental CDRs, which are conducted across system for other system components.

Chapter 7
DEVELOPMENT

Overview

Introduction

You are now at a point where you have completed system and process SRR, SDR, PDR and CDR. You have received guidance and approvals from the SPO and using commands and have developed a good working relationship with the SMEs. Here lessons are produced and products are tested. This is where diligent analysis, planning and design efforts will pay dividends. As development begins, you may need to revisit earlier phases of ISD.

Purpose

The purpose of this chapter is to describe the ISD development phase and the various specific actions required in the application of ISD to defense system acquisition.

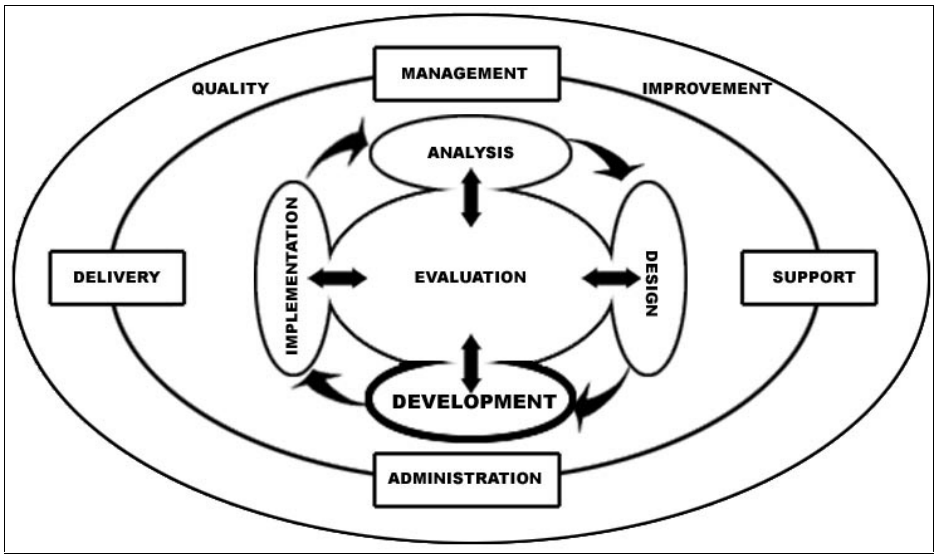
Where to read about it

This chapter contains eight sections.

ISD phase

You are now at the development phase. This phase is highlighted in Figure 15.

Figure 15 Development Phase



Section A
Lesson Outlines/Flow Diagrams

Introduction

Now that you have entered the development phase of ISD, you begin to focus on the development of lessons. In this phase, the contractor will review plans and designs, and will have frequent formal and informal meetings with SMEs, the SPO and using command representatives.

Purpose

The objectives of lesson outlines/flow diagrams are to define scope, content, duration, and schedule of contractor-developed courses.

Contractor tasks

The contractor will:

Develop lesson outlines and flow diagrams for each lesson based on course- level PIDS requirements and the course and lesson objectives shown in the syllabus.

Air Force tasks

The SPO will:

Review (spot-check) lesson outlines and flow diagrams against PIDS requirements and the course and lesson objectives shown in the syllabus.
Arbitrate SME comments.
Elevate areas of concern as required to resolve.

In addition, SMEs will review all lesson outlines and flow diagrams, elevating areas of concerns as necessary.

Metrics

The Air Force should:

Ensure the integrity of the production resource-tracking device used as a tool to evaluate contractor performance throughout the production process.
Verify schedule integrity.

Continued on next page

Metrics (Continued)	Look at number of discrepancies (DR) or revision recommendation forms for each lesson and the severity of the write-up. Look for trends across production base. Look at volume of SME comments as check of contractor understanding. Review all products for conformance with style and format guide. (Cutting corners? Unauthorized changes?) Ensure that requirements traceability is preserved. Do lesson outlines reflect a comprehensive course design?
Higher system level activities	At this stage, the system-level CDR is conducted.

Section B
Lesson Strategy/Lesson Plans

Introduction

Outlines and flow diagrams have been developed. Now the contractor will actually build the lesson strategy and write lesson plans for standup instruction.

Purpose

The purpose of lesson strategy and lesson plan development is to provide the subject matter content, instructional strategies and other supportive information for each lesson. A lesson strategy may be a data item but would normally be incrementally reviewed on-line prior to the critical design review.

Contractor tasks

The contractor will:

Develop lesson strategy for ICW lessons (also called "lesson spec").
Develop lesson plans (standup instruction).
Define CBT level and authoring system features to be exploited for each lesson.
Review integration of lessons to courses.

Note: CBT development lead-time is critical. Plan for it.

Air Force tasks

The Air Force will review (spot-check) lesson strategies and lesson plans against PIDS requirements and the course and lesson objectives shown in the syllabus.

The SMEs will review all instructional strategies and lesson plans, elevating areas of concern to the SPO.

Metrics

The Air Force should track:

Lesson production status against the production plan baseline:
By lesson
By course

Courseware production personnel staffing numbers and experience against production plan baseline
Number of changes to functional requirements vs. total number of functional requirements
Courseware development action items
SME discrepancies

Section C
Storyboards

Introduction

As lesson plans are being written, storyboarding is also occurring where required. Storyboards become the visualization of the training sequence. They are the sketches and narration notes of this visual process. The ultimate goal is to facilitate learning with student participation and individualized instruction.

Purpose

Storyboards provide a blueprint for the production of interactive courseware. This includes scripting information and visual representatives of the materials to be presented. Storyboards also provide information and directions for the programmer and the instructional designer necessary for coding.

Contractor design tasks

The contractor will develop storyboards and integrate courses to each other and to the total training system.

Air Force tasks

The Air Force will spot-check storyboards and lesson integration against PIDS requirements and the course and lesson objectives shown in the syllabus. SMEs will review all storyboards, elevating areas of concern.

Section D
Coding, Programming, Writing

Introduction

The ISD development phase is the stage where instructional materials are actually created. Some work in this area may have been started earlier but efforts will now be intensified. At this point, you may be coding, programming, or writing, depending on the scope of the training being developed.

Purpose

The purpose of this stage is to create all audiovisual and other necessary instructional materials. Additionally, mission scenarios and student/instructor lesson guides are produced.

Contractor tasks

Depending on the contract, the contractor will:

Write lesson guides for instructors and students.
Create all other instructional materials.
Create mission scenarios.
Code and debug.
Prepare for lesson-level tests (individual tryouts).

Air Force tasks

The Air Force will review instructional materials and mission scenarios. SMEs will review all lesson guides and instructional materials.

Higher system level activities

The Air Force will correlate traditional courseware development with courseware to be embedded within other training devices; for example, mission scenarios incorporated within weapon system trainers.

Note: Incremental development of PDRs, CDRs, SGTOs, and CRRs will occur throughout this stage at the direction of the SPO.

Figure 16 Example Diagram of Incremental Lesson Production and Evaluation.

Continued on next page

Section E
Lesson Tests (Individual Tryouts)

Introduction

As lessons are completed, tests must be conducted to validate the lessons. These tests will be conducted on an individual basis as well as in small groups. This section will cover individual tryouts (ITO).

Purpose

The purpose of testing is to validate the lessons and courses and to allow adjustments and improvements to be made before full-scale implementation. By using ITOs, the contractor can collect and analyze performance data from representative students to identify major errors in all of the courseware.

Contractor tasks

The contractor will:

Test all lessons (in accordance with courseware test plan).
Select/provide surrogate students.
Evaluate lessons from the SMEs' perspective, ensuring proper lesson content.
Collect/analyze data.
Analyze and fix discrepancies.

Air Force tasks

Before the ITOs began, the SPO approved the questionnaire and comment forms. During the test, the SPO has been an active observer, especially through the SMEs. As the tests are ongoing, the SPO will conduct spot checks of actual instruction and data generated by the tests. Upon completion of the tests, the SPO will review the data and select any issues that are appropriate for resolution. Issues need to be addressed by the entire team at a resolution meeting.

The using commands are very active in this stage. They will:

Provide students for the tests.
Monitor contractor conduct of tests (through SMEs).
Conduct check of all data generated by tests.
Review data to identify issues for resolution.

Continued on next page

Air Force tasks (Continued)

AETC may participate in the ITOs as both observers and students. They will compare the planned lessons and course with the actual performance and will prepare an appropriate report listing comments, issues, and concerns for resolution.

Metrics

The Air Force should ask questions and make comparisons such as the following:

Does the contractor intend to test all of the lesson production (ITOs)?
- If less:
  - Why?
  - Is sample viable?
- Are courses selected representative?

What is the number and severity of test discrepancies identified?

Compare actual course length (from tryouts) against planned course length (may imply a major rewrite). Remember that training objectives should determine course length.

Track training discrepancy (TD) correction rate.
- How fast does contractor correct errors?
- Will corrections be incorporated in time for small-group tryout?
- Is contractor using resources effectively?
- Are personnel required for correction consistent with personnel plan?

Are incremental tests running in accordance with formative evaluation plan?

Section F
Course-Level Integration Tests

Introduction

Course-level integration tests are conducted between ITOs and Small-Group Tryouts (SGTOs). Actual media and equipment are used so that any discrepancies noted can be fixed before continuing into the next stage.

Purpose

The purpose of these tests is to ensure that the courseware is ready for the SGTO, and that it has been integrated so that all components fit together logically and effectively.

Contractor tasks

The contractor will:

Provide government with surrogate student requirements.
Use questionnaires and comment forms.
Perform test against PIDS.
Perform test from a student perspective.
Focus on integration across lessons.
Use actual (final) delivery media if available; make-do work-arounds may be used if necessary.
Collect/analyze data and discrepancies.
Document test results.
Analyze and fix discrepancies.

Air Force tasks

The Air Force will:

Review comment forms and questionnaires developed to support integration tests.
Review test resources, schedules, and test support plans; ensure integrity of test activity. Ensure availability of surrogate students.
Review (spot-check) data generated by test.

The using command will provide students for course level integration tests. The SMEs will:

Monitor contractor conduct of tests and comment as necessary.
Check data generated by tests.
Review data to identify issues for resolution.

Section G
Small-Group Tryouts

Introduction

Now that individual tryouts have been conducted and integration tests performed, corrections should have been made to the lessons and other applicable courseware. SGTOs will now be conducted to test the courseware on a larger scale.

Purpose

SGTOs are conducted to collect data from a more realistic sample of the actual student population. These students will be from the target audience and will use actual equipment, identical environment and other parameters that will be found in the full-scale course. This data will be used to make additional modifications as necessary before the large-group tryout.

Contractor tasks

The contractor will:

Use questionnaires and comment forms.
Integrate production HW/SW media.
Conduct test using actual, final lesson materials, and all other supporting media (or work-arounds) required to make the course "whole."
Perform SGTO.
Verify system function from the student's viewpoint.

Collect/analyze data and discrepancies.
Document test results.
Analyze course run time and student performance.
Analyze and fix discrepancies.

Air Force tasks

The Air Force will:

Review and approve comment forms and questionnaires developed to support SGTOs.
Review test resources, schedules, and test support plans.
Ensure integrity of test activity.
Ensure availability of surrogate students as agreed.
Review (spot-check) data generated by test.

Continued on next page

Air Force tasks (Continued)	The using command will provide students for SGTO. The SMEs will monitor contractor conduct of tests and check 100% of data generated by the tests.
Higher system level activities	The Air Force will: Check system interfaces and integration. Ensure that courseware delivery media are properly integrated.

Section H
Iterative Remedy and Retest

Introduction

Now that incremental tests have been conducted and test results data have been analyzed, corrections must be made to the lessons and courses as required. As with all previous actions, this is a team process involving the contractor, SPO and using commands. This is a critical stage as this is the final step before the final course readiness review (CRR).

Purpose

The purpose is to identify and remedy all discrepancies and retest before getting approval to proceed to implementation.

Contractor tasks

Using data from the ITOs and SGTOs and guidance from the SPO, the contractor will:

Conduct a resolution meeting consisting of contractors and Air Force SGTO observers to fix discrepancies.
Submit any discrepancies not received at resolution meeting to the Curriculum Review Board (CRB) for approval.
Fix discrepancies.
Repeat SGTO as necessary.
Provide data to support Functional Configuration Audit (FCA).
Support conduct of FCA.
Finalize all draft data item submissions.
Provide final site implementation.

Air Force tasks

The SPO is now at the final approval stages of ISD development. But before implementation can begin, the following must be done.

SMEs verify that all courseware materials are ready for training.
At conclusion of SGTO retest, program office and user review contractor remedies for all discrepancies. The SPO arbitrates SME comments.

Elevate issues of concern as required to ensure resolution.

Continued on next page

Air Force tasks (Continued)

Conduct FCA and CRR.
- Verify that courses meet PIDS.
- Verify that PIDS:
  - Are performed on-site.
  - Use real students.
  - Use full classes.
  - Have all relevant media work-arounds in place.
- Verify that FCA is held open until all discrepancies have been corrected and approved by the SPO.

The SPO, SMEs, and users review and approve the functional configuration audit.

While the SMEs are taking various actions, as members of the government team, as specified above, their primary role is to verify that all courseware materials are ready for training.

AETC will verify that lessons and courses are ready for implementation and that:

- Technical data are available, current and incorporated into the material.
- Course content reflects actual defense system.
- User needs are met.

Metrics

Before the CRR, the Air Force will verify the following:

- Are requirements to complete CRR reflected in CRR checklist?
- Do CRR checklists meet SEMS criteria?
- Are any test discrepancies still outstanding? (All should be cleared prior to the CRR.)

Acquisition milestone

The CRR is conducted following completion of the above tasks.

Chapter 8
IMPLEMENTATION

Overview

Introduction

This is the reason you began the ISD process in the first place to conduct instruction. You have developed and validated an instructional system, have developed and validated lessons and courses, and now it is time to become operational. This chapter covers the system functions and planning required to implement instruction.

Note: Seasoned carpenters say "Measure twice, cut once." Learn from that and do a double check to make sure system functions are in place, working and ready (see System Functions, page 10). Ensure that all previous planning has been completed. It will be time well spent.

Purpose

The purpose of this chapter is to explain the major events that must occur to help ensure successful implementation.

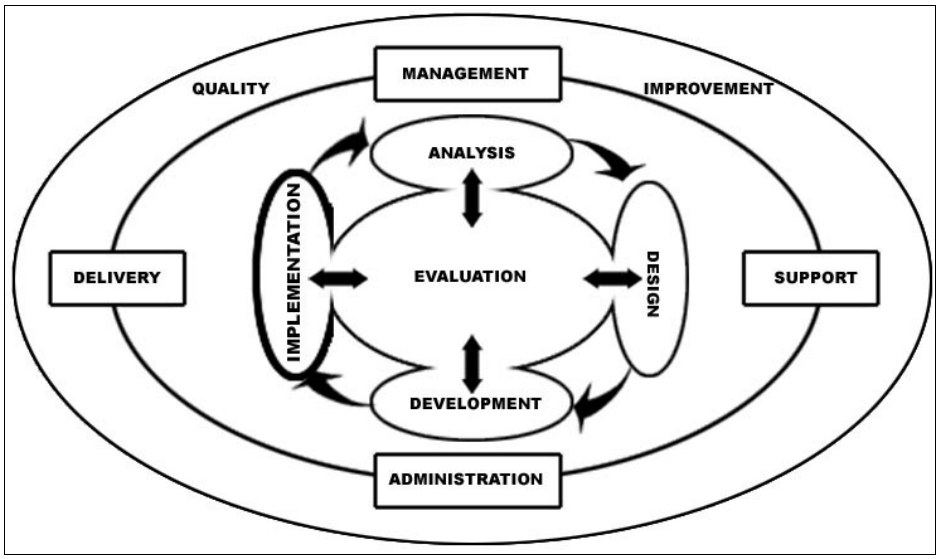
Where to read about it

This chapter contains four sections.

ISD phase

Now you are at the implementation phase. This phase is highlighted in Figure 17.

Figure 17 Implementation Phase



Section A
Site Training Readiness Review

Introduction

After all CRRs for a training site have been completed, a site training readiness review (STRR) [also called Site Readiness Review (SRR) or on-site review] will be conducted.

Purpose

This review is conducted at each site to confirm that the site is ready to conduct training.

Contractor tasks

The contractor will support the STRR by showing that the desired objectives and standards have been achieved. The contractor will:

Collect data supporting summative evaluation.
Document results in test report.
Provide data to support STRR.

Air Force tasks

The SPO will approve the STRR based on success criteria and checklists, and participate in contractor's status briefings. In addition, the SPO will conduct the STRR if in a non-guaranteed student program.

The using command will provide support as required.

AETC will participate in on-site reviews and ensure that the site is ready for training, reviewing items such as:

Facilities (training and support)
Training equipment
Courseware
Instructors

AETC will ensure that all are in place and ready, or that suitable, temporary work-arounds are developed.

Milestone

A site training readiness review is conducted.

Section B
Implementation of System Functions

Introduction

Earlier, you learned that the system functions must be in place before a training system can operate. You also learned that there were four basic system functions:

Management
Support
Administration
Delivery

These functions are critical to the instructional system implementation process. This process will operate effectively and efficiently only if these functions are in place and in use.

Purpose

The purpose of the system functions is to support the instructional infrastructure.

Where to read about it

This section covers four topics.

Management Function

What it is

Management is considered to be the practice of directing or controlling all aspects of the instructional system. These activities are an integral part of conducting instruction. A system cannot be properly implemented without the system management function in place.

Who is responsible?

Each level within the instructional activity has various management responsibilities depending on the activity or program.

Example: A program or project manager may have overall management responsibility, while an instructor may have management responsibility more focused on the teaching or learning activity.

Categories of management activities

Management activities required to support implementation of an instructional system can be categorized into five areas, as shown below.

Category	Management Activity Examples
Planning	Develop Preliminary Training System T&E Plan Develop Defense System Data Support Plan
Organizing	Establish ISD Management Team Schedule People, Work and Resources
Coordinating	Conduct Meetings with Staff and Contractor Conduct On-Site Visits and Reviews
Evaluating	Monitor Milestones, Budgets, Deliveries Collect and Analyze Data
Reporting	Provide Status Briefings Develop Program Reports

Support Function

What it is

Support may be defined as the maintainer of the system. This includes long-range planning, as well as day-to-day activities.

Like the other systems functions, support is a vital component of the ISD system team.

Example

Support can include:

- Providing student services
- Maintaining equipment
- Providing spare parts
- Maintaining courseware

Who is responsible?

Management has overall responsibility for support, but various activities have different responsibilities. Examples are:

- Acquisition – acquires equipment
- Logistics – maintains and supports

Administration Function

What it is

Administration is the function that is concerned with the day-to-day tasks of operating an instructional system. Administration is a form of management or supervision that absorbs tasks not clearly appropriate elsewhere. Administration contributes significantly to the overall effectiveness of the instructional system. In fact, every phase of ISD is affected by administration.

Example

Systems administration can include:

Maintaining documentation
Processing reports
Filing data

Who is responsible?

All activities get involved in administration. Key offices include:

Registrar section
Instructor staff
Clerical staff

Delivery Function

What it is

Delivery is the means used to provide instruction to students.

Examples of delivery methods

Examples of system delivery methods include:

- Instructors
- Computers
- Workbooks
- Simulators

Who is responsible?

All activities directly involved in the instructional system have responsibilities such as the following.

The training manager in system acquisition ensures that adequate planning has been done before selecting the delivery method.

Instructional designers select the most appropriate delivery method and report to management.

Instructional staff use and evaluate the selected delivery method for effectiveness.

Section C
Full-Class Tryouts

Introduction

Full-Class Tryouts (also called Large-Group Tryouts) are conducted to complete one final test before the training system is considered fully implemented. This tryout is conducted on-site in the real environment, using real students, full classes and all required media.

Purpose

The purpose is to fully test the training system, identifying discrepancies and remedying as necessary. It also validates the training system's capability to accommodate incremental and systematic integration of all components of a training system without degradation to system performance and training effectiveness.

Contractor tasks

The contractor will conduct the tryout in a guaranteed student program. The contractor will support the Air Force in a non-guaranteed student program. The contractor will also collect data supporting summative evaluation and document results in a test report.

Air Force tasks

The Air Force will:

Approve tryouts based on success criteria and checklists.
Conduct tryouts in non-guaranteed student program.
Support tryouts if contractor conducts.

Section D
Mature System Performance Review

Introduction

After the system has been operational and functional for a period for time, it will be continually evaluated. At a certain point in its operation, however, a mature system performance review will be conducted. It will be conducted on-site in a real environment, using full classes of real students.

Purpose

The purpose of this review is to see if the system is performing as designed and expected and to identify any modifications needed.

Contractor tasks

The contractor will conduct or support the review, depending on the contract. The contractor will also collect data supporting summative evaluation, documenting any changes required and test results.

Air Force tasks

The using command will conduct or support operational evaluation throughout the life cycle of the system.

Chapter 9
EVALUATION

Overview

Introduction

Evaluation occurs throughout the ISD process. Once instruction has been conducted, the Air Force will be specifically concerned with determining how well the training is achieving its objectives. Evaluation is the feedback that helps ensure that training objectives are achieved and the quality of graduates' performance is acceptable. The process continuously evaluates the course to determine if it is operating as designed. For example, six months after students graduate, are they still able to meet job performance requirements? If not, why not? Is it because of shortfalls in the course? Should changes in the course be undertaken? These are the kinds of questions you must ask and reviews you must make to ensure that the training that was developed is effective and efficient. You have already begun evaluation as you started with formative evaluation at the beginning of planning with development of the evaluation plan. Now you must do more.

Purpose

The purpose of this chapter is to describe the evaluation process that is used to continually evaluate the effectiveness and efficiency of training.

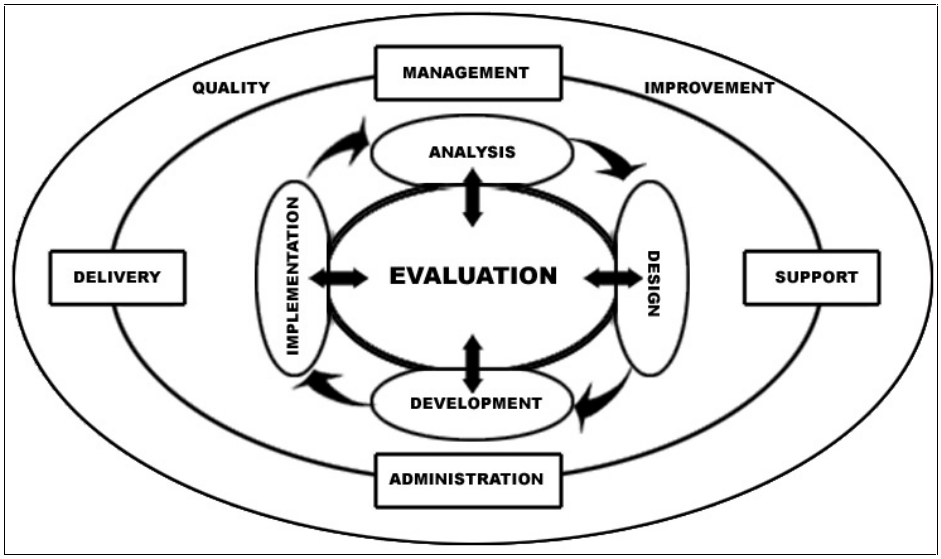
Where to read about it

This chapter contains three sections.

ISD phase

As you can see in Figure 18, evaluation has the most emphasis. It is conducted throughout the ISD process, with each ISD phase being involved with evaluation.

Figure 18 Evaluation



Section A
Formative Evaluation

Introduction	Evaluation occurs throughout the ISD process, but formative evaluation occurs during development, production, and test activities. It is the period from the beginning of planning to course readiness review or validation of materials. Formative evaluation should be part of the T&E plan, which was developed earlier.
Purpose	The purpose of formative evaluation is to evaluate lesson/course development during the "formative" stages and allow for corrections (remedies) to be made before training is fully implemented.
What is included?	As part of the T&E plan, formative evaluation is conducted during development, ITO, and SGTO. It is not a process in itself, but a series of events that are all part of formative evaluation. The data collected is used to make lesson/course corrections and is provided to the SPO for their review and action as necessary.
Air Force tasks	The SPO reviews data and provides guidance as requested.
Additional information	Formative evaluation includes acceptance testing of equipment and software, performance verification of system components, formative evaluation of courseware, and training system development. The courseware formative evaluation plan is outlined in the system test plan. The results of formative evaluation are reviewed in the CRR.

Section B
Summative Evaluation

Introduction

Summative evaluation begins at the Courseware Readiness Review (CRR), overlaps the formative evaluation phase, and terminates at the Training System Readiness Review (TSRR).

Summative evaluation assesses the training system in the operational environment to validate the baseline established earlier. It will check for full system integration.

Purpose

The primary purpose of summative evaluation is to determine whether the training developed for the students is effective and efficient. It is the process of collecting data from students, instructors, and other key evaluation interfaces as they use instructional media in the actual training environment. Its purpose is also to identify instructional materials, training media or instructional management system components that result in poor learning, inefficiency, or poor student acceptance. This data will then drive improvements.

Summative evaluation answers questions such as:

How well has the training been accomplished as reflected by operational requirements?
Do graduates of a course meet established training system and operational performance standards?
Are the training system performance standards correct?
How can the training be better accomplished?

What is included?

Summative evaluation is a form of quality improvement that evaluates the "summed" effect of the total training program. It should begin at CRR/validation and go through TSRR. In the acquisition business, this is both internal and external.

Internal evaluation

Internal evaluation determines the adequacy of each component of the training program such as instruction, materials, equipment, and facilities. It is conducted within the instructional system or "schoolhouse." It determines how well each component contributes to the production of quality graduates. Internal evaluation for a contractor-operated training system is usually conducted by the contractor and reviewed/approved by the SPO and/or using command.

External evaluation

External evaluation determines how well graduates are meeting job performance requirements – the reason for training them in the first place. In external evaluation, the contractor will assess the degree to which skills obtained during the course are generalized effectively to the operational unit environment. External evaluation utilizes information from the field, such as feedback from supervisors of graduates. The SPO and/or using command will review/approve results of external evaluations.

How to conduct evaluations

Internal evaluations can be conducted by reviewing:

- Course documents
- Resources
- Instructional facilities
- Instructor performance
- Measurement programs

External evaluations can be conducted by:

- Questionnaires
  - For graduates
  - For supervisors
- Field notes
- Job performance evaluations

Section C
Operational Evaluation

Introduction

Operational evaluation is the continuation of evaluation throughout the life of the fully operational training system. Operational evaluation occurs on a system regardless of whether it is contractor- or Air Force-operated. The operational evaluation is similar to summative evaluation except it is continuous and reflects long-term operational data.

Purpose

The purpose of operational evaluation is to provide real-time data for use in reviews, updates and quality improvement of training systems. It is continuous improvement.

Who conducts?

The training source and the contract determine who conducts the operational evaluation. The best way to do this is to use the following table.

If training system is operated by:	Then operational evaluation is conducted by:	And supported by:	With approval evaluation by:
Contractor (Total Contractor Training)	Contractor	Using Commands	SPO
USAF (Contractor-developed, USAF-operated Turnkey)	USAF	Using Commands	SPO

What is included?

Operational evaluation is a continuation of the procedures and data collection begun in summative evaluation. It usually starts at the TSRR and lasts throughout the life cycle of the program. The emphasis shifts from establishing the instructional value of the courses to detecting flaws or deterioration. The prime goal is to maintain and improve course quality throughout the life cycle. The following issues should be addressed in operational evaluation:

- Measurement and assessment of student learning in comparison to established training requirements and objectives
- Measurement of terminal objectives (qualification/certification)
- Identification and resolution of discrepancies and deficiencies in courseware
- Assessment of training in light of modification/upgrades in the defense system

How is it conducted?

Operational evaluation is conducted by both internal and external means.

Internal evaluation can be conducted by reviewing:

- Course documents
- Resources
- Instructional facilities
- Instructor performance
- Measurement programs
- Other sources as necessary

External evaluations can be conducted by using:

- Questionnaires
  - For graduates
  - For supervisors
- Field visits
- Job performance evaluation
- Other methods (i.e., SIMCERT Simulator certification)

Chapter 10
AIR FORCE-DEVELOPED MAINTENANCE TRAINING

Overview

Introduction

This chapter is for the individual who has been charged with managing or being on a team responsible for applying ISD to Air Force-developed maintenance training concurrently with defense system acquisition. This application would normally take place during the early acquisition cycles of a new defense system, but could occur late in the cycle or even after the system has been fielded. Regardless of when your involvement begins, this chapter will help ensure that you do the right thing at the right time.

Description

Maintenance training is performance- or knowledge-based training for people who will maintain defense systems. The term *defense system* is all-encompassing. A defense system is not limited to aircraft, bombs, guns or missiles, but can include anything needed to support the mission. For example, radars, computers, trucks and engines can be considered part of these systems.

Where to read about it

This chapter contains two sections. The first section explains the major functions in applying ISD to Air Force-developed maintenance training. Section B provides an explanation of a 15-step ISD process used in maintenance training.

Note: This chapter is primarily applicable to maintenance training. However, it contains several management tools that can assist you in various ISD tasks, no matter what your involvement or function. Use and adapt as you desire.

Section A
Major Functions in Applying ISD to Air Force-Developed Maintenance Training

Introduction

The major functions of applying ISD concurrently with acquisition are general in nature and cover the normal management-type areas. This section has been written as if you are to be a team chief or project manager of a portion of the ISD team. Modify the guidance provided to best suit your needs.

Critical Factors

There are many functions that determine the level of success. These include the following topics:

Planning
- Scheduling
- Collecting/reviewing data

Building work teams
Training
Managing workloads
Conducting meetings
Timeliness
Quality

Planning

Planning for training development is one of the most important activities required for successful program management. Proper planning requires you to **make time** on your calendar for this critical item. Planning includes anything needed for successful completion of the project.

Make time on your calendar.

Planning activities

Some key planning activities are:

Scheduling
Collecting and reviewing data

Scheduling

Scheduling is the process of defining what needs to be done and when it must be done to facilitate the smooth progression of work leading to project completion. Several tools are available to assist you. The ones you select will depend on your needs.

Scheduling tools

Some scheduling tools include Gantt charts and PERT charts. Examples are shown in Figures 19 and 20, respectively.

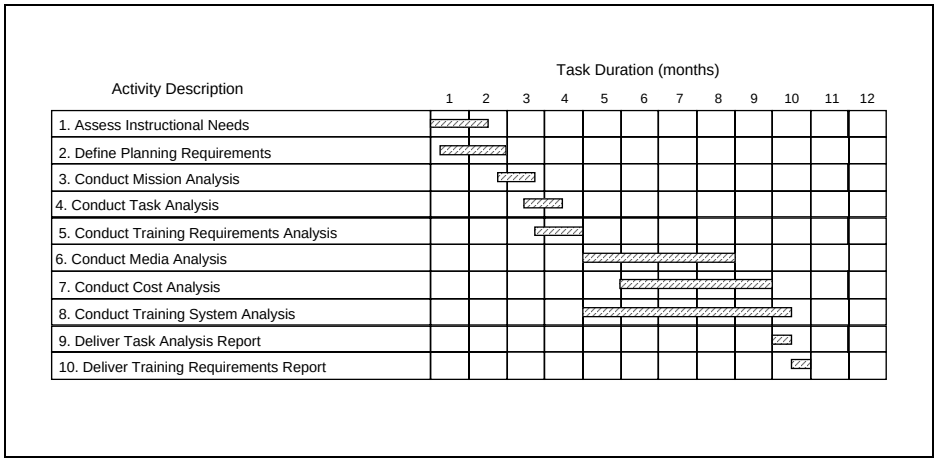
Gantt charts

Gantt charts are an organizing tool to visually indicate resources and activities with a designated time frame. They are used to compare planned completion dates with actual performance. These charts consist of a list of tasks to be accomplished and the time allowed for each. Some tasks are sequential and some are overlapping. A Gantt chart contains:

Horizontal time scale that depicts the length of the project
Vertical axis with list of all activities involved in the project
Horizontal bar indicating duration of each activity

Example

Figure 19 Example Gantt Chart



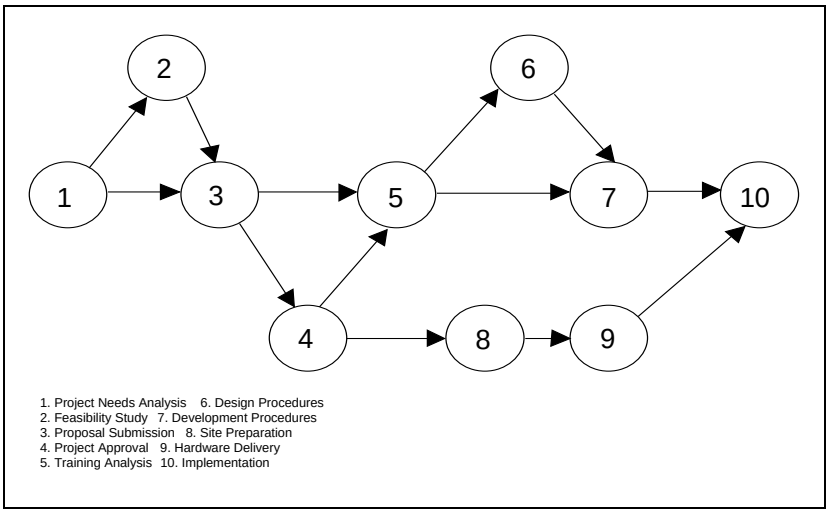
PERT charts

PERT charts also show key data but include dependencies of activities. They can help determine critical events and dates, and help decide where resources can be better utilized and where management attention is most needed. A PERT chart contains:

Box for each sequentially arranged activity required to complete the project
Depiction of input-output contingencies among activities

Example

Figure 20 Example PERT Chart



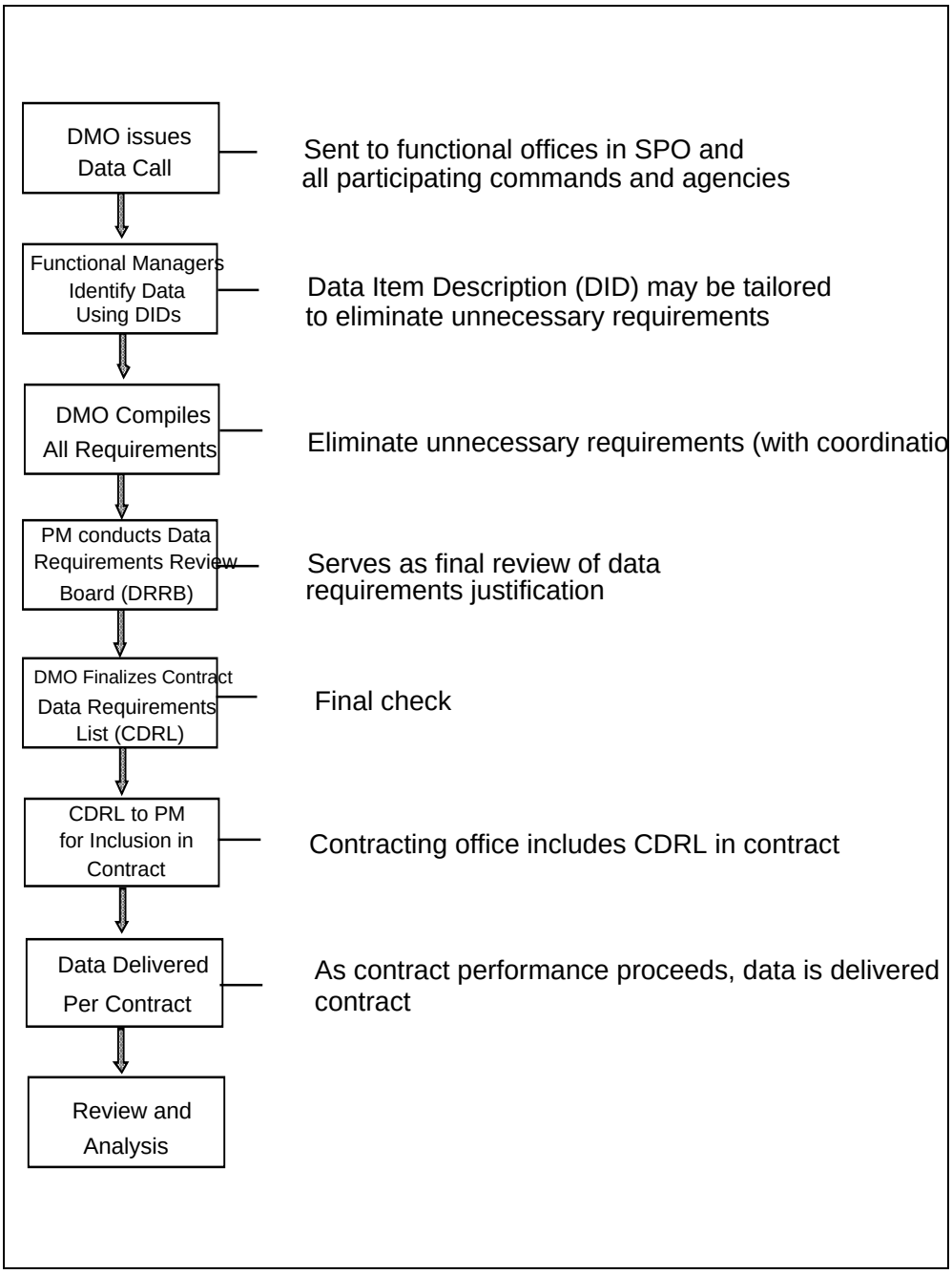
Collecting and analyzing data

Collecting and analyzing data occurs during the life of the acquisition, beginning at concept exploration. Data can be anything from blueprints to performance characteristics to various training reports. The SPO Program Manager (PM), through the Data Maintenance Office (DMO), is responsible for acquiring the contractor data necessary to manage all aspects of the program. The data collection and analysis process is depicted in Figure 21.

Continued on next page

Collecting and analyzing data (Continued)

Figure 21 Data Collection and Analysis Process



Data Process

Data examples

Some examples of data include:

Program schedules
Training and Training Equipment Plan (TTEP)
Training support data
Course critiques
ISD management plan

*Note: Do **not** request or accept data unless you have a valid need. Data is expensive, more so when it is unnecessary.* *See Discussion on MIL-HDBK-29612 on Page 52.*

Building work teams

Once you have developed a schedule and begun to collect and analyze data, you will have a better understanding of the type of staff members you will need to pull onto your team. Do this very carefully. Success depends on teamwork and dedication to the project. There are limitless numbers of books on team building and leadership secrets to success; but there are no short cuts. Check the books, review your leadership and management course materials, and talk to your network of trusted bosses and former bosses, as well as successful peers. Learn from them. Team members may come from unit resources or from TDY locations.

Training

Never assume that your team knows all there is to know. If they have worked on ISD projects before, and have been successful, then you can assume that they know what needs to be done. What you must do is set the work and training standards up front. Explain the project to the team and establish your rules of order. Survey the team and develop appropriate training. It may be something as simple as telephone etiquette to something as complex as preparing a wiring diagram of electrical components in a widget. The goal of ISD is to produce training and increase skills and knowledge, but you should do it for your team first and not neglect your own training.

Managing workloads

If you've been a manager for any length of time, you have heard that the best way to manage workloads is to "delegate." But delegation alone does not foster success. You must know what and to whom to delegate. You must follow up, and know when to follow up. No one ever admits to having extra personnel that they want to give you to help out. So you must use your staff to manage as necessary. Use the computer or manual systems for tracking.

Conducting meetings

"Everyone hates meetings." Not true! Everyone hates non-productive, worthless meetings. Make sure yours are productive. Don't have a meeting for the sake of a meeting. Have an agenda, stick to it, take notes, publish minutes and follow up. Expect the same of your staff. Meetings are for communication, but they also keep the team informed and on the right track.

Timeliness

"The early bird gets the worm." Maybe, but earlier you built a schedule. If you built it right, stick to it and deliver as promised. If there is a legitimate reason for slippage in the schedule, inform your superiors. They would rather have an honest person who wants to build and deliver a quality product with a schedule delay than an inferior product on time.

Quality

"If you don't have time to do it right the first time, when will you have time to fix it?" Quality and timeliness go hand-in-hand and cannot be overemphasized. Your team should focus on quality and continuous improvement.

Section B
ISD Process Applied to
Maintenance Training Acquisition Environment

Introduction

If you read AFMAN 36-2234, you learned that the original ISD model was considered to be a five-step process, even though the "steps" were not intended to be followed in a typical "step-by-step" process but in phases. The revised model has phases that should be done in a continuous process, not step-by-step. You learned earlier that ISD is a never-ending process. You will learn through practical experience that in your particular operation or program, modification of the phases may facilitate application of ISD. If this helps ensure a quality product that meets the user's training objectives, then do it.

The following example is a synopsis of a 15-step ISD process provided for your information and use as appropriate. This 15-step process was designed to fit the peculiarities and limitations of the AF-developed maintenance training acquisition environment. It is taken from the procedures used by the 374 Training Development Squadron (TDS) of Air Education and Training Command (AETC) as they apply ISD to new or significantly modified defense systems. The ISD phases with the 15-step process are listed below. **Note: This is only an example of one organization's application of ISD.**

Continued on next page

Introduction (Continued)

Air Force ISD Phases	Step	374 Training Development Squadron ISD Process
Analysis	1	Identify System Requirements
	2	Identify Characteristics of the Target Audience
	3	Determine Task-Based Training Requirements
	4	Determine Concept-Based Training Requirements
	5	Determine Media and Methodology
Design	6	Develop Instructional Strategies
	7	Identify Hardware Fidelity Requirements
	8	Identify Interactive Courseware Fidelity Requirements
	9	Identify Instructional Features
Development	10	Prepare Training Equipment Functional Specification
	11	Prepare Course Control Documents
	12	Prepare Instructional Materials and Tests
	13	Validate Instruction
Implementation	14	Conduct Training
	15	Evaluate Training

Applications

The maintenance training system (or portions) for most major Air Force defense systems has been developed using these procedures. Examples include:

B-1B
B-2
C-17
Joint STARS

Other uses

By modifying the 15-step process (deleting or changing steps), these procedures have been successfully applied to operator training, ISD training, additional duty training, TQM training and others. Use and modify as appropriate for your project.

Note: This section is a synopsis only. The 15-step process is explained in further detail in Attachment E.

Background

As you learned earlier, the acquisition ISD process actually begins when HQ USAF issues a PMD to the major commands. This document directs the SPO to begin system acquisition. The SPO then develops a PMP, which outlines responsibilities and general management objectives. HQ AETC provides inputs to Section II, Training, of the PMP. Part of AETC's responsibility, in support of a new defense system, is test participation. The Director of Technical Training Operations makes the assignment of a Responsible Agency (RA), HQ AETC/TTO (example, the 374 TDS was the RA for the B-1 program).

374 TDS participation plan

The 374 TDS, Plans and Evaluation branch, submits a proposed Participation Plan (PP) to HQ AETC/TTO. The PP shows how the 374 TDS proposes to manage ISD and test activities.

Continued on next page

374 TDS participation plan (Continued)

Section	Description
1	Section 1 of the PP outlines objectives, background, related documents, schedules, and resources required for planning purposes.
2	After coordination with prime and associate centers, HQ AETC approves the PP and forwards Section 2 (ISD Objectives, Methodology, Schedules, and Resource Requirements) to the prime training center for inclusion in the Training Participation Plan (TPP) as the ISD Annex.
3	Section 3 [Operational Test and Evaluation (OT&E) Objectives, Methodology, Schedules, and Resource Requirements] is forwarded to either the Air Force Operational Test and Evaluation Center (AFOTEC) or the Responsible Test Organization (RTO). HQ AETC then approves required personnel authorizations (identified in the PP) for the 374 TDS. Personnel for these authorizations may be drawn from the prime center, using command, or others as directed by the Field Training Group (FLDTG).

ISD team organization

The 374 TDS begins the ISD effort by organizing an ISD team. Whenever possible, a senior NCO experienced in squadron and test management procedures is assigned as Acquisition Training Development Manager (ATDM). The ATDM leads the ISD team. This person is responsible for meeting the objectives outlined in the PP. The ATDM also ensures that the ISD team is trained in the 15-step ISD process for acquisition and is familiar with AFMAN 36-2234, AFH 36-2235, and AFI 36-2201. When trained, the ISD team begins compiling data on system maintenance requirements. Once the data are collected, the ISD team begins the analysis.

TRRRM

The results of the ISD analysis [training and Technical Training Material (TTM) requirements] are then reviewed by participating agencies in a Training Requirements Recommendation Review Meeting (TRRRM). The TRRRM is designed to review, consolidate, and coordinate AETC TTM recommendations. It is also used to review proposed Course Control Documents (CCDs) prior to further action.

TRRRM participants

Participants in the TRRRM, other than 374 TDS, may include the HQ AETC Training Staff Officer (TSO), HQ AETC Training Equipment Resources Manager, Field Training Group, Training Support Squadron, prime center Plans and Resources personnel, and associate center Plans and Resources personnel.

TRRRM results

The result of the TRRRM is a consolidated package of recommended TTM/CCDs. The package is reviewed by the Program Office (PO) (for funding and procurement action), who develops system specifications for each hardware training device. Specifications are then reviewed by HQ AETC and placed on contract by the PO.

Purpose

The purpose of allowing AETC personnel to review these specifications (before contracting) is to ensure that the TTM satisfies objectives identified during analysis. Subject matter specialists (SMS) may also participate in design reviews to ensure that required characteristics, as well as changes, are incorporated. Changes for training hardware after the TRRRM may require modification to the contract. Transition of SMSs to the first training site is scheduled to support operational requirements. SMSs become the nucleus of the initial instructor cadre. Procured TTM is delivered, installed, and operationally checked at the training site by contractors. When all resources are in place, the final ISD step can begin. By actively seeking system information during the early phases of System Acquisition/Test and Evaluation and applying ISD, AETC can provide the PO with appropriate TTM requirements.

Synopsis of 15-step process

The following is a synopsis of the 15-step ISD process.

Step	Title	Description
1	Identify System Requirements	During this step, references are researched and data gathered concerning a given Air Force Specialty Code (AFSC); specifically, the duties and tasks performed in an AFSC.
2	Identify Characteristics of the Target Population	This step is used to analyze previously learned skills and knowledge to determine a target population definition.
3	Determine Task-Based Training Requirements	What students can already do (Step 2) is subtracted from what they must do (Step 1). The remainder is defined as "potential training requirements," or what students must be taught.
4	Determine Concept-Based Training Requirements	Here, the analyst determines if fundamental concepts (ideas) need to be taught, such as principles of fluid dynamics or atomic structure.
5	Determine Media and Methodology	The best media class to satisfy a given training requirement is chosen in this step as well as the best method of instruction for the media class.
6	Develop Instructional Strategies	Skills and knowledge are re-sequenced into activities, activities into tasks, and tasks into units of instruction. Also, written guidance is developed for important/ specific aspects of the training scenario.
7	Identify Hardware Fidelity Requirements	Procedures within this step enable analysts to determine how closely (functionally and physically) hardware training devices must mimic actual system hardware
8	Identify ICW Fidelity Requirements	Behavioral training requirements and concepts, with ICW, are analyzed to determine peculiar features.

Continued on next page

Synopsis of 15-step process (Continued)

9	Identify Instructional Features	Analysts determine who/what provides stimuli, response, feedback, and next activity for training requirements.
10	Prepare Training Equipment Functional Specification	This document compiles conclusions of the ISD effort. It specifies the number and type of hardware trainers, functional and physical capabilities, instructional features, etc.
11	Prepare Course Control Documents	This step involves preparation of Course/Specialty Training Standards, Course Charts, and Plans of Instruction.
12	Prepare Instructional Materials and Tests	Study guides, workbooks, handouts, and any other materials required for the course are developed at this time.
13	Validate Instruction	This is accomplished while presenting a "dry run" of the entire training scenario. The training is "fine-tuned" for maximum transfer of learning and continuity.
14	Conduct Training	The training is actually conducted.
15	Evaluate Training	This is the evaluation of training, both internal and external. Remember that evaluation has been occurring throughout the process.

Chapter 11
INTERACTIVE COURSEWARE (ICW)

Overview

Introduction

There are additional considerations when you acquire interactive courseware (ICW). A successful acquisition of ICW requires a team effort. You can get assistance from within your organization and by referring to:

AFH 36-2235, Volume 5, Interactive Courseware (ICW) Design, Development, and Management Guide
MIL-HDBK-284-1, Interactive Courseware (ICW) for Military Training, Manager's Guide for Development, Acquisition, and Management
MIL-HDBK-284-2, Interactive Courseware (ICW) for Military Training, Probability Practices
MIL-HDBK-284-3, Interactive Courseware (ICW) for Military Training, Glossary

Purpose

The purpose of this chapter is to give general guidance for contractor-developed ICW.

AFH 36-2235, Volume 5A

This USAF Handbook provides information and guidance for applying current instructional technology and the ISD process as described in AFMAN 36-2234. It is useful in helping to decide when to use ICW and provides many guidelines and decision aids.

MIL-HDBK-284-1

This handbook (MIL-HDBK-284-1) describes all phases of ICW analysis, design, development, implementation, and logistic and life cycle support. This handbook is intended to be used in conjunction with MIL-HDBK-29612, Military Training Programs.

MIL-HDBK-284-2

Also to be used with MIL-HDBK-29612, this handbook (MIL-HDBK-284-2) can help ICW device manufacturers, developers, and users implement the mandatory software interface and command requirements for ICW and authoring systems. Information and guidance is provided for:

Continued on next page

MIL-HDBK-284-2 (Continued)

Personnel responsible for defining operational training requirements
Life cycle support
ICW development
Acquisition
Implementation

MIL-HDBK-284-3

This handbook (MIL-HDBK-284-3) is a comprehensive glossary containing definitions of all key terms used in the above handbooks. Key terms used in MIL-HDBK-29612 are repeated in this handbook to provide a single comprehensive glossary of terms and definitions related to military training and interactive courseware.

Tailoring

Detailed information on the process for acquiring ICW should be tailored to agree with your acquisition strategy. This tailoring should include deliverable data requirements.

Proposal grading

The following table presents a method for evaluating ICW proposals leading to a contract award.

MIL-HDBK-284-1 PROPOSAL GRADING SCHEME

Proposal Division	Evaluation Level	Evaluation Scoring
Volume	Evaluation area	Color (assign colors to denote area is exceptional, acceptable, marginal or unacceptable)
Chapter	Evaluation item	Adjective (exceptional, acceptable, marginal or unacceptable)
Section	Evaluation factor	Points
Paragraph	Sub-factor	Check (acceptable), Plus (exceeds requirements), or Minus (deficient)

Negotiated acquisition process

There are many activities that occur during a negotiated acquisition of ICW. An extended list is available in MIL-HDBK-284-1, and is summarized below.

NEGOTIATED ACQUISITION PROCESS

Milestone	Activities
1	Define requirements and gather background data. Prepare acquisition plan and gain approval.
2	Prepare solicitation package.
3	Conduct reviews and gain funding commitment.
4	Issue synopsis in Commerce Business Daily (CBD). Conduct pre-solicitation conference.
5	Issue solicitation. Conduct pre-proposal conference.
6	Evaluate proposals. Prepare evaluation report.
7	Negotiate contract.
8	Carry out pre-award actions.
9	Award contract.
Post-Award	Conduct kick-off meeting. Carry out in-process reviews.

Other contracts

Besides negotiated contracts, other ICW contracts include:

ICW front-end analysis (FEA) contracts
ICW design, development and implementation (DD/I) contracts
ICW integrated logistic support (ILS) contracts

Portability practices

MIL-HDBK-284-1, Part 2, provides guidance on implementing the software interface and command requirements established by DODI 1322.20 and MIL-HDBK-29612. The goal is to ensure that ICW and authoring systems are portable.

RICHARD E. BROWN III, Lt. General, USAF
DCS/Personnel

ATTACHMENT 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

REFERENCES

AFPD 36-22	Military Training
AFI 36-2201	Developing, Managing and Conducting Military Training
AFI 36-2301	Professional Military Education
AFMAN 36-2234	Instructional System Development
AFMAN 36-2236	Handbook for Air Force Instructors
AFH 36-2235	Information for Designers of Instructional Systems (12 Volumes)
Vol 1	ISD Executive Summary for Commanders and Managers
Vol 2	ISD Automated Tools/What Works
Vol 3	Application to Acquisition
Vol 4	Manager's Guide to New Education and Training Technologies
Vol 5	Advanced Distributed Learning: Instructional Technology and Distance Learning
Vol 6	Guide to Needs Assessment
Vol 7	Design Guide for Device-based Aircrew Training
Vol 8	Application to Aircrew Training
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Vol 10	Application to Education
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Abbreviations and Acronyms

AETC	Air Education and Training Command
AF	Air Force
AFH	Air Force Handbook
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFMC	Air Force Materiel Command
AFOTEC	Air Force Operational Test and Evaluation Center
AFP	Air Force Pamphlet
AFPD	Air Force Policy Directive
AFSC	Air Force Specialty Code
ASP	Acquisition Strategy Panel
ATDM	Acquisition Training Development Manager
ATS	Aircrew Training System
CALS	Computer-Aided Logistics Support
CBI	Computer-Based Instruction
CBT	Computer-Based Training
CCD	Course Control Document
CDC	Career Development Course
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CI	Configuration Item
CIDS	Configuration Item Development Specifications
CRB	Course/Curriculum Review Board
CRR	Course Readiness Review
CW	Courseware
DEMVAL	Demonstration and Validation
DID	Data Item Description

DMO	Data Maintenance Office or Data Management Office/Officer
DoD	Department of Defense
DODI	Department of Defense Instruction
DR	Discrepancy Report
DT&E	Developmental Test and Evaluation
FCA	Functional Configuration Audit
FEA	Front-End Analysis
FLDTG	Field Training Group
GFE	Government Furnished Equipment
GFP	Government Furnished Property
HQ	Headquarters
HW	Hardware
IAW	In Accordance With
ICW	Interactive Courseware
ILS	Integrated Logistic Support
IMPACTS	Integrated Manpower, Personnel & Comprehensive Training & Safety
IOC	Initial Operational Capability
IPP	IMPACTS Program Plan
ISD	Instructional System Development
ITO	Individual Tryout
JPR	Job Performance Requirement
LGTO	Large-Group Tryout
LSA	Logistics Support Analysis
MAJCOM	Major Command
MER	Manpower Estimate Report
MIL-HDBK	Military Handbook
MIL-STD	Military Standard
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NCO	Noncommissioned Officer
OPR	Operational Test and Evaluation
OT&E	Operational Test and Evaluation
PDR	Preliminary Design Review
PEM	Program Element Monitor
PERT	Program Evaluation and Review Technique
PIDS	Prime Item Development Specifications
PM	Program Manager
PMD	Program Management Document/Directive
PMP	Program Management Plan
PO	Program Office
PP	Participation Plan
PRGC	Program Requirements Guidance Conference
QA	Quality Assurance
QAF	Quality Air Force

QC	Quality Control
QI	Quality Improvement
RA	Responsibility Agency
RAA	Required Assets Available
RDD	Required Delivery Date
RFI	Request for Information
RFP	Request for Proposal
RTO	Responsible Test Organization
SEGC	System Engineering Guidance Conference
SEMP	System Engineering Management Plan
SEMS	System Engineering Master Schedule
SFI	Search for Information
SGTO	Small-Group Tryout
SIMCERT	Simulator Certification
SKA	Skills, Knowledge, and Attitudes
SME	Subject Matter Expert
SMS	Subject Matter Specialist
SOW	Statement of Work
SPO	System Program Office
SRD	System Requirements Document
SRR	System/Site Readiness Review
STP	System Training Plan
STRR	Site Training Readiness Review
STS	Specialty Training Standard
SW	Software
TD	Training Discrepancy
TDS	Training Development Squadron
TDY	Temporary Duty
T&E	Test and Evaluation
TMS	Training Management System
TO	Technical Order
TPM	Technical Performance Measure
TPP	Training Participation Plan
TPT	Training Planning Team
TRAR	Training Requirements Analysis Report
TRRRM	Training Requirements Recommendation Review Meeting
TSBA	Training System Basis Analysis
TSC	Training System Concept
TSIP	Training System Implementation Plan
TSO	Training Staff Officer
TSR	Training System Requirements
TSRA	Training System Requirements Analysis
TSRR	Training System Readiness Review
TSSC	Training System Support Center
TTEP	Training and Training Equipment Plan

TTM	Technical Training Material
TTO	Technical Training Operations
USAF	United States Air Force
WBS	Work Breakdown Structure

Terms

The following list of definitions includes those terms commonly used to discuss training, training systems and acquisition of training systems as they relate to instructional system development and as used in this handbook. The list is not to be considered all-inclusive.

Acquisition. The procurement by contract, with appropriated funds, of supplies or services (including construction), by and for the use of the Federal Government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated.

Acquisition Management Systems and Data Requirements Control List (AMSDL). A listing of Source Documents and Data Item Descriptions (DID) which have been approved for repetitive contractual application in DoD acquisitions and those that have been canceled or superseded. The AMSDL is identified as DoD Directive 5010.12-L. Also see **Data Item Description**.

Acquisition Plan. A document that records program decisions; contains the user's requirements; provides appropriate analysis of technical options; and includes life cycle plans for development, testing, production, training, and logistic support of material items.

Acquisition Program. A directed, funded effort that is designed to provide a new or improved material capability in response to a validated need.

Administration. The function concerned with the day-to-day tasks of operating an instructional system. Administration is a form of management or supervision that tends to be a catchall activity to absorb tasks not clearly appropriate elsewhere. Administration contributes significantly to the overall effectiveness of the instructional system.

Affective Domain. A classification of educational objectives that focus on the development of attitudes, beliefs, and values.

Affective Learning. A domain of learning concerned with the acquisition of desired perceptions by the trainee; that is, the order and discipline required within the military. It is that part of trainee learning objectives which requires the acquisition of perceptions by the trainee; promoting, for example, self-confidence, responsibility, respect, dependability, and personal relations. Also see **Learning Objective**.

Aircrew Training System (ATS). A contractor-produced, -operated and -maintained ground-based system used to train aircrew members. ATS includes training equipment, software, firmware, hardware, devices, courseware, training system support, logistics support, ground-based instruction, media, and facilities. It typically does not include flight training or aircraft support.

Analysis. (a) Examination of system requirements. (b) Separation of a whole into its component parts for detailed study or examination; for example, a job is broken down into all its observable components, duties, tasks, task elements, and skills. (c) A level of cognitive domain in which people are able to break down complex organizational structures into their component parts. (d) Assembly of a complete data bank of information.

Ancillary Materials. Documents that integrate the use of instructional media materials by directing the instructor and trainee use of the materials and providing supplemental information. Ancillary materials may be self-study workbooks, lecture guides, trainee guides, exercise controller guides, or instructor utilization handbooks.

Ancillary Training. Training in subjects that pertain to the duty performance of personnel but are separate from the individual's primary job. Included is training in those subjects not identified by the individual's job description. A program identified as ancillary training may not necessarily be ancillary training to all personnel who receive it.

Application. (a) The way in which technology is used. (b) A level of cognitive domain in which trainees are able to use learned material in new and concrete situations. (c) Application software. (d) The process of reviewing and selecting from available specifications, standards and related documents those which have application to particular material acquisitions, and contractually invoking them wholly or in part at the most advantageous time in the acquisition cycle.

Attitude. (a) The emotions or feelings that influence a learner's desire or choice to perform a particular task. (b) A positive alteration in personal and professional beliefs, values, and feelings that will enable the learner to use skills and knowledge to implement positive change in the work environment. Also see **Knowledge** and **Skill.**

Audiovisual Medium. Any delivery device or system that provides both audio and visual presentations.

Automated Task Analysis. A computer-assisted environment that prompts the analyst to input the required information and stores the results in a computer-managed database.

Baseline Comparison System. An existing or predecessor system or combination of systems with characteristics similar to the proposed weapons system. The system is

normally used during front-end analysis to help predict proposed weapons system manpower, personnel, and training (MPT) requirements.

Baseline Data. Valid and reliable information about the current level of performance of the intended trainee population. Baseline data can be used to confirm the need to develop new instruction or can be used as a comparison in ascertaining differences between the trainees' performance before and after instruction.

Behavior. Any activity, overt or covert, capable of being measured.

Behavioral Objective. See **Learning Objective.**

Behavior Analysis. (a) The process by which a complex behavior is broken down into teachable components. (b) The analysis of each task or subject area to determine what the trainee must do upon completion of instruction, how and how well the trainee must be able to do it, and what skills and knowledge must be taught in order for the trainee to meet the end of instruction.

Behavior Indicator. See **Sample of Behavior**.

Block of Instruction. A group of related instructional units or modules covering a major subject area.

Block Update. A process whereby several modifications may be grouped together to maintain training system concurrency in the most cost-effective, efficient manner, while reducing training device downtime.

Cadre Training. Training of an initial (nucleus) group of personnel, such as instructors.

Case Study. A learning experience in which trainees encounter a real-life situation under the guidance of an instructor/computer in order to achieve an instructional objective.

Class Capacity. The number of trainees that may be trained per class, expressed in terms of three constraining factors: (1) Personnel allowance – number of trainees that may be trained per class based on the number of instructor and non-instructor billets/authorizations contained in the manpower authorization and used locally to support the course; (2) Equipment – number of trainees that may be trained per class based on the amount of equipment available per scheduled class period; and (3) Classroom space – number of trainees that may be trained per class based on the availability of classroom space for a specific class. Classroom/training space includes laboratory, shop, hangar, or any other space configured for training purposes.

Class Frequency. The number of times a course will convene during a fiscal year.

Cognitive Domain. A classification of educational objectives characterized by their dependence upon the manipulation of the mental process (thinking, understanding).

Collective Training. Instruction and applied exercises that prepare an organizational team (such as a squad, aircrew, battalion, or multi-service task force) to accomplish required military tasks as a unit.

Competency-Based Instruction. Instruction that is derived from and organized around an agreed-upon set of competencies and that provides learning experiences designed to lead to the attainment of these competencies.

Computer-Assisted Instruction (CAI). The use of computers to aid in the delivery of instruction. A variety of interactive instructional modes are used including tutorial, drill, practice, gaming, simulation, or combinations. Students interact with instruction presented through a variety of media, usually computer-controlled or -monitored. CAI is an integral part of computer-based instruction (CBI) and computer-based training (CBT). Also called Computer-Aided Learning.

Computer-Based Instruction (CBI). The use of computers to aid in the delivery or management of instruction. Also called Computer-Based Education and Computer-Based Learning.

Computer-Based Training (CBT). Training in which computers are used for both training delivery and training management. The management functions often include scheduling, lesson selection, score keeping, and quality of student responses.

Computer-Based Training System. A training system consisting of computers that provide instruction. It is an automated, integrated instructional system that includes the design and development of instructional materials (authoring system), the management and administration of training, and the delivery of that instruction.

Computer-Managed Instruction (CMI). The use of computers to manage the instructional process, generally including tasks such as registration, pretesting, diagnostic counseling, prescription of learning experiences, progress testing, post testing, determination of student mastery of objectives, and disenrollment.

Condition. That portion of the learning objective that describes the situation/environment in which the trainees write/express/perform the specified behavior. Conditions include any pertinent influence on task performance, including any or all of the following: location of performance, environment, equipment, manuals, or supervision required.

Contract. A mutually binding legal relationship obligating the seller to furnish the supplies or services (including construction) and the buyer to pay for them. Contracts include all types of commitments that obligate the Government to an expenditure of

funds and that, except as otherwise authorized, are in writing. In addition to bilateral instruments, contracts include (but are not limited to) awards and notices of awards; job orders or task letters issued under basic ordering agreements; letter contracts; orders, such as purchase orders, under which the contract becomes effective by written acceptance or performance; and bilateral contract modifications.

Contract Data Requirements List (CDRL). A list of the data requirements authorized to be acquired for a specific acquisition, which is made a part of the contract. Uses DD Form 1423.

Contract Deliverables. Materials delivered by a contractor. Examples of contract deliverables are lesson plans, trainee guides, and test packages. Also see **Deliverable Data**.

Contracting Activity. An element of an agency designated by the agency head, and delegated broad authority regarding acquisition functions.

Contract Logistics Support (CLS). A preplanned method used to provide all or part of the logistics support to a system, subsystem, modification, or equipment throughout its life cycle. CLS covers depot maintenance and, as negotiated with the operating command, necessary organizational and intermediate (O&I) level maintenance, software support, and other operation and maintenance (O&M) tasks.

Contractor. An individual or organization outside the Government, which has accepted any type of agreement or order for providing research, supplies, or services to a Government agency.

Contractor-Acquired Property. Property acquired or otherwise provided by the contractor for performing a contract and to which the Government has title. Also see **Contractor-Furnished Equipment** and **Government Property**.

Contractor-Furnished Equipment. Items manufactured or purchased by the contractor for inclusion in or support of contract work. Also see **Contractor-Acquired Property**.

Contractor Plant Service. See **Factory Training**.

Contractor Specialized Training. See **Factory Training**.

Contractor Support. A generic support method of supplementing Air Force logistics resources either for a temporary period or for the life of a system or equipment.

Contractual Data Requirement. A data requirement that applies by virtue of the terms of a contract.

Controlled Testing. A controlled study to test or evaluate an item or subject, used, for example, for obtaining validation data.

Correspondence Course. A self-study course consisting of instructional material and an assignment booklet (or lessons) for administration to nonresident trainees. Also see **Extension Training**.

Cost/Benefit Tradeoff Analysis. An analytic approach to solving problems of choice. It requires definition of objectives, identification of alternative ways of achieving each objective, and identification for each objective of that alternative that yields the greatest benefit for a given cost or produces the required level of benefits at the lowest cost. When the benefits or outputs of the alternatives cannot be quantified in terms of dollars, this process is referred to as cost-effectiveness analysis. Also see **Cost-Effectiveness Analysis**.

Cost-Effectiveness. (a) A comparative evaluation of potential instruction methods and media to determine the most efficient alternative. (b) A measure of the operational capability added by a system as a function of its life cycle cost.

Cost-Effectiveness Analysis. A comparative evaluation of potential instruction methods and media to determine the most efficient alternative.

Course. (a) Logically grouped instruction on a subject, designed to achieve predefined learning objectives. Usually concerns a single job or task (job-skills-type training) or a section of organized knowledge (information-type training). (b) A complete series of instructional units identified by a common title or number. (c) An ordered arrangement of subject matter designed to instruct personnel in the knowledge, skills, or attitudes required for the performance of tasks in a designated area of specialization. A course consists of one or more modules. Also see **Curriculum**; **Lesson**; and **Module**.

Course Chart. A qualitative course control document that states the course identity, length, and security classification, lists major items of training equipment, and summarizes the subject matter covered.

Course Documentation. Information describing the current content of a course (instructional materials, tests, instructor's guide, evaluation plan, trainee guide) and its developmental history (job analysis, criteria for selecting tasks for training, previous revisions).

Course Evaluation. A critique of the course to include course effectiveness, instructor effectiveness, technical documentation effectiveness, and effectiveness of training media.

Course Map. A chart that identifies tasks to be learned, sequences them in desirable order for learning, and indicates possible routes for learning when bottlenecks develop.

Course Mission. The ultimate purpose of the course including whom is to be trained, what is to be trained, the degree of qualification brought about by the training, and where and under what general conditions the graduate will perform on the job.

Course Readiness Review (CRR). An Air Force review on a course-by-course basis for the purpose of checking whether the course is ready for use in training. Following successful CRR, the course is approved for use either by a training contractor or by the Government training organization. CRR commences after completion of small-group tryouts. Successful completion of CRR marks the beginning of system-level formative evaluation.

Course Training Standard. A document that identifies the most common tasks and knowledge requiring advanced training of specific equipment or systems, within an Air Force Specialty.

Courseware. Training materials such as technical data, textual materials, audiovisual instructional materials, and computer-based instructional materials.

Courseware Integration. Mixing of interactive courseware with other training media (for example, classroom, laboratory, simulators, on-the-job training).

Courseware Maintenance. (a) Revision of curriculum after implementation. (b) Repairing, changing, replacing, or any other manipulation of implemented courseware after a customer has accepted it, or after it is determined to be correct in accordance with the Statement of Work (SOW).

Criterion. (a) The standard by which something is measured. (b) In test validation, the standard against which test instruments are correlated to indicate that accuracy with which they predict human performance in some specified area. (c) In evaluation, the measure used to determine the adequacy of a product, process, behavior, and other conditions.

Criterion Behavior. Performance required of the course graduate, which is described by the terminal objective and measured by the criterion test.

Criterion-Referenced Instruction. (a) A way of organizing and managing instruction in which pre-specified performance criteria are achieved by each qualified trainee. (b) Instruction designed to teach only those performances that are specified as critical to the successful accomplishment of a defined task. Also see **Performance-Oriented Training**.

Criterion-Referenced Objective (CRO). (a) A performance-oriented tool identifying criteria and actions required to demonstrate mastery of a task. (b) An objective with prescribed levels of performance. Each CRO contains a behavior (task statement), a

condition (available equipment, checklists, and governing directives, or the situation requiring the task), and a standard (regulation, operating instruction) for the task.

Criterion-Referenced Test (CRT). The process of determining, as objectively as possible, a student's achievement in relation to a fixed standard based on criterion objectives.

Critical Sequence. In training development, sequencing of topics or objectives according to their importance.

Curriculum. A set of courses constituting an area of specialization. The curriculum includes all training conducted within a school, outlined into specific topics, along with detailed training objectives, to include behavior, conditions, and standards. Also see **Course**.

Curriculum Materials. All materials required for the presentation of information and the development of skills in formal training. The materials are a collection of various visual, printed (that is, instructor and trainee guides), and audiovisual materials (that is, instructional media), including interactive courseware, used in direct support of a curriculum.

Curriculum Outline. A detailed chronological listing of units/modules and lesson topics with estimated times of coverage in sequential order with the learning objectives they support.

Data. (a) Recorded information, regardless of form or characteristics. (b) Basic elements of information that can be processed, stored, or produced by a computer. (c) Facts or numerical values resulting from measurement (observation) of situations, objects, people, or events.

Database. (a) A collection of information, having one or more common elements, organized for sorting and quick retrieval. (b) A program that files information. (c) Systematically organized computer data files for central access, sorting, quick searching, retrieval, and update.

Data Item Description (DID). A completed form that defines the data required of a contractor. The form specifically defines the data content, preparation instructions, format, and intended use (see DOD-STD-963). In acquisition of training for defense systems, see MIL-HDBK-29612. Uses DD Form 1664. **Acquisition Management Systems and Data Requirements Control List**.

Data Product. Information that is inherently generated as the result of work tasks described in a Source Document or contract. Such information is treated as a separate entity (for example, drawings, specifications, manuals, reports, records, or parts list).

Decision Point. (a) A point at which a program path can go in two or more directions. (b) A point at which there are two or more options.

Decision Support System. The Joint Service ISD/LSAR Decision Support System. The system is a set of software tools that provides training decision support analysis for front-end instructional system development analysis (task selection for training, learning objectives analysis, instructional setting selection, instructional sequencing, media selection, and training equipment requirements analysis).

Decision Tree. (a) A flowchart or graphic representation of the sequence of a specific activity or operation. (b) A system based on the premise that decisions spawn outcomes that require other decisions. Choices feed into a network of other decisions (usually represented by branches).

Defense Audiovisual Support Activity. An organization designated by the Department of Defense to produce and acquire audiovisual products and to provide audiovisual support for all DoD components in a specified geographic area.

Defense Instructional Technology Information System (DITIS). A standard, DoD-wide database designed to facilitate ICW resource sharing within the DoD components by providing a central source of ICW information. The DITIS database provides information on all DoD-owned ICW programs, whether fielded or under development, including information on delivery systems, operating software, authoring tools and courseware for both planned and fielded ICW systems.

Defense School or Course. A school or course used by two or more military services that is administered by a coordinating service/agency and that presents a curriculum developed under the policy guidance and approval authority of an element of the Office of the Secretary of Defense.

Defense System. Any weapon system, support system, or end item that supports a specific military mission, therefore requiring operations, maintenance, or support personnel training.

Defense System Training. Organized training conducted in a formal situation on weapons, weapon systems, and related equipment for both operations and maintenance personnel. Also called **Weapon System Training.**

Defense Technical Information Center (DTIC). The organization that acquires, stores, retrieves, disseminates, and enhances technical information for research and development for Government and industry.

Deliverable. See **Deliverable Data**.

Deliverable Data. For purposes of this handbook, the task outputs/data items identified in DoD Inst. 29612 for acquisition. These outputs/data items are identified and defined by DIDs and are intended to be cited on the Contract Data Requirements List (CDRL) for delivery by the contractor. Also see **Contract Deliverables**.

Desktop Training Device. An off-the-shelf, commercially available, computer-based training system consisting of both hardware and software.

Developmental Testing. The initial stage in which the instructional material is tried out with individuals and small groups of trainees to determine if the product teaches the subject and to locate portions of the instructional materials that need to be revised. Also see **Formative Evaluation**.

DoD Index of Specifications and Standards (DODISS). The publication that lists federal and military specifications, standards, and related standardization documents and non-Government documents that is used by the military departments and agencies.

Domain of Learning. A generic classification of learning outcomes into one of three primary but not necessarily mutually exclusive categories: cognitive (thinking, understanding), affective (attitudes, values), and psychomotor (physical skills).

Effectiveness. The degree to which a training product or program meets its stated training objectives.

Electronic Media. Devices used in the application of computer and communications technologies to automate and support the free exchange of digitized technical data in support of the development, delivery, and maintenance of training materials.

Embedded Training. Training provided in capabilities not specifically required for mission completion, but that are built into or added onto operational systems, subsystems, or equipment to enhance or maintain user skill proficiency.

Enabling Objective. A learning objective describing what is expected of the trainee in demonstrating mastery of the skills and knowledge necessary for achievement of a terminal objective or another enabling objective.

Entry-Level Training. The introductory and indoctrination training given to individuals upon initial entry into a new job.

Entry Skills. Specific, measurable behaviors that have been determined through the process of analysis of learning requirements to be basic to subsequent knowledge or skill in the course.

Environment. The physical conditions and surroundings in which a job is performed, or in which learning takes place, including tools, equipment, and job aids.

Equipment. (a) Any device that supports any system or subsystem. (b) A major unit of a subsystem for which operation and maintenance can be performed.

Evaluation. A judgment expressed as a measure or ranking of trainee achievement, instructor performance, process, application, training material, and other factors (see MIL-HDBK-29612). It includes **Formative Evaluation**; **Operational Evaluation**; and **Summative Evaluation**.

Evaluation Information. Information collected for the purpose of assessing performance of trainees, conduct of instruction, support of instruction, or any other aspect of the instructional process.

Evaluation Plan. A method or outline of a set of procedures that will be used to gather data and information for the purpose of assessing a course of instruction or other training product.

Evaluation Program. A schedule for the coordinated, systematic, and continuous assessment of the efficiency and effectiveness of the training system, its processes and products.

Exercise. (a) An act that is performed or practiced in the learning experience to develop, improve, or display a specific knowledge, skill, or aptitude. (b) The total instruction that a trainee receives from a training experience.

Expert Opinion. Those opinions, impressions, or judgments of individuals considered to be well qualified in relation to the item under evaluation. Also see **Subject Matter Expert**.

Extension Training. Training, either individual or collective, that is usually conducted at locations other than service schools or training centers. Also see **Correspondence Course**.

Extension Training Material. All exportable training products, including materials that are exported from one resident school to another as well as to operational units.

External Evaluation. The acquisition and analysis of feedback data from outside the formal training environment to evaluate the graduate of the instructional system in an operational environment. Also see **Operational Environment.**

Factory Training. Training or instruction provided by a vendor or manufacturer on how to maintain or operate a specific piece of equipment. Also called **Contractor Plant Service** and **Contractor Specialized Training**.

Familiarization Training. Field training to acquaint personnel with a specific system or to keep personnel abreast of changing concepts and requirements.

Feedback. (a) Information that results from or is contingent upon an action. Information on trainee performance is "fed" back to the trainee so he/she can improve that performance; to the instructional designer so he/she can improve materials and procedures on the basis of trainee needs; and to the management system so it can monitor the internal and external integrity of the instruction and make appropriate revisions. (b) Computer response to trainee input.

Fidelity. The degree to which a task or a training device represents actual system performance, characteristics, and environment.

Field Test. Tryout of any training course on a representative sample of the target population to gather data on the effectiveness of instruction in regard to error rates, criterion test performance, and time to complete the course. Also see **Individual Tryout** and **Small-Group Tryout**.

Field Training. Technical, operator or other training conducted at operational locations on specific systems and associated direct-support equipment.

Field Validation. The point in training product development when the product is administered to a representative sample of job incumbents. The intent is to exercise the product in a realistic environment to determine the administrative feasibility and the appropriateness of the product for the target population; determination that tasks taught in residence and extension are, in fact, applicable to the trainee's job. Also see **Individual Tryout** and **Small-Group Tryout**.

Firmware. The combination of a hardware device and computer instructions or computer data that reside as read-only software on the hardware device. The software cannot be readily modified under program control.

Flowchart. (a) Documentation of the courseware instructional strategy. (b) A visual method of indicating the many relationships of the sub-parts of a process, including steps and decision points. (c) A programming guide that is a graphic representation of all branching and data processing required for the interactive courseware. (d) A diagram that depicts the events or actions and their sequence in the program. (e) A map of interactive logic, representing the possible paths a user can take in the courseware, and comprising standard symbols for program segments, decision points, clues, responses, and logic flow. (f) A diagram representing the logic flow of a computer program, using standard graphic shapes and symbols joined by straight lines and representing program segments, decision points, execution flow, and other information.

Flow Diagram. A graphic representation of actions/events required in accomplishment of a task (for example, lesson development). Frequently accompanied by a narrative description, the flow diagram provides specific instructions and precise sequencing for task/goal accomplishment.

Follow-on Training. Training conducted after initial training.

Formal Lecture. A structured and often rehearsed teaching session with no verbal participation by trainees.

Formal Training. Training in an officially designated course conducted or administered in accordance with appropriate course outline and training objectives.

Formal Validation. The process of determining if the instructional and learning objectives of the courseware are being met.

Format. (a) Organization of data in a specific way to meet an established system standard. (b) The process of readying a new floppy or hard disk by having a computer program write file mark and track mark codes on the disk. (c) The magnetic arrangement of a disk into areas or sectors so it can receive and store data from the operating system that formatted the disk. (d) The desired organization, structure, or arrangement of the content of the data product described by the Data Item Description (DID); related to the shape, size, makeup, style, physical organization, or arrangement of the data product described in the DID. (e) In print and audiovisual, the distinctive and recurring treatment, shape, size, and style of a publication's page or sections achieved through stylized composition and typographic make-up (for example, line length, type face, and size).

Formative Evaluation. An activity that provides information about the effectiveness of training materials to meet training objectives and the trainees' acceptance of training materials as they are being developed. Also see **Developmental Testing** and **Evaluation.**

Front-End Analysis. A process that evaluates requirements for manpower, personnel, and training (MPT) during the early stages of the military system acquisition cycle. Its purpose is to determine manpower, personnel, training and safety requirements under alternative system concepts and designs and to estimate the impact of these MPT requirements on system effectiveness and life cycle costs.

Functional Grouping. The organization of instruction so that tasks related to the same procedures or equipment are presented together.

Gantt Chart. A visual representation of project tasks showing the duration of each task along a timeline.

Generic Courseware. Courseware that is not specific to one organization and that appeals to a broader market.

Government-Furnished Equipment (GFE). Equipment that has been selected to be furnished by the Government to a contractor or Government activity for installation in, or for use with, or in support of the system/equipment during production, conversion, or modification. Also see **Government Property**.

Government-Furnished Information (GFI). Information to be furnished by the Government to a contractor. Also see **Government Property**.

Government-Furnished Material (GFM). Documents, equipment, facilities, and services supplied to a contractor before and during the execution of a contract. Also see **Government Property**.

Government-Furnished Property (GFP). Property (real and personal, including facilities, material, special tooling, special test equipment, and agency-specific property) in the possession of or directly acquired by the Government and subsequently made available to the contractor. GFP includes documents, equipment, facilities, and services supplied to a contractor before and during the execution of a contract. Also see **Government Property**.

Government/Industry Data Exchange Program (GIDEP). A cooperative data interchange among Government and industry participants seeking to reduce or eliminate expenditures of time and money by making maximum use of existing knowledge. GIDEP provides a means to exchange certain types of data essential during the life cycle of systems and equipment.

Government Property. All property (real and personal, including facilities, material, special tooling, special test equipment, and agency-specific property) owned by or leased to the Government or acquired by the Government under the terms of the contract. It includes **Contractor-Acquired Property**; **Government-Furnished Equipment**; **Government-Furnished Information**; **Government-Furnished Material**; and **Government-Furnished Property**.

Group-Paced Instruction. Instructor-centered training with fixed periods of instruction. All class members or small groups are instructed on the same task at the same time.

Guaranteed Student. The product of a contracted training system that assures that graduates achieve specific performance levels according to the approved user tasks and standards documents.

Guided Discussion Method. A learning experience in which students participate in an instructor-controlled, interactive process of sharing information and experiences related to achieving an instructional objective.

Hardware. (a) The physical components of a system. (b) The physical components and equipment that make up a computer system (everything except the programs or software), including peripheral devices.

Higher Levels of Learning. Those levels of learning above the comprehension level that may be considered as the practical application of concepts and principles to complex real problems.

Human Factors Engineering. The application of human performance principles, models, measurements, and techniques to system design. Human performance is an integral part of system design characteristics that affect the efficiency of operating, servicing, programming, and repairing the system.

Human Systems Integration. The process of effective integration of human factors engineering, manpower, personnel, training, health hazards, and safety considerations into the acquisition of defense systems to improve total system performance and reduce costs by focusing attention on the capabilities and limitations of humans.
Illustration. The use of graphics, animation, or any kind of visual demonstration within a lesson.

Implementing Command. The command or agency designated by the Air Force Acquisition Executive to manage an acquisition program.

Individualized Instruction. (a) Instruction that attends to the individual needs of, and differences among, students. (b) A method of training in which the subject, content, presentation rate, and presentation media are tailored to the needs of the individual student. (c) A lesson design that accommodates diverse ability levels or desires. (d) Training that allows each student to determine the pace, start time, amount, and kind of instruction based on individual goals or objectives, entry-level skills, choice of learning media, and criterion-referenced measures for determining mastery. Also see **Self-Paced Instruction**.

Individual Training. Instruction provided to an individual military member, in either a centralized training organization or an operational unit, which prepares the trainee to perform specified military tasks.

Individual Training Standards (ITS). The standards used to specify individual training proficiency requirements (tasks) that support unit mission performance.

Individual Tryout (ITO). A test of the effectiveness of a unit of instruction on individual students who are representative of the intended target population and revision of these materials as necessary. Also see **Field Test** and **Field Validation**.

Informal Training. (a) Training accomplished by actions for which structuring ("programming") is not specifically planned beforehand. (b) "On-the-job training" or "on-board training" by which skills or knowledge are acquired or improved while assigned productive tasks. (c) Training that takes place in the work environment during the normal day-to-day contacts between a supervisor and subordinates. (d) Training accomplished by self-instruction, as contrasted to supervised or instructor-led training.

Initial Design. The first basic concept, usually expressed as a flowchart and treatment, that deals with a block of information and the manner in which the blocks will interact, rather than with portions of a lesson or procedure.

Initial Operational Capability (IOC). The first attainment of capability to effectively employ a weapon, item of equipment, or system of approved specific characteristics, and which is manned or operated by an adequately trained, equipped, and supported military unit or force.

Initial Qualification Training. Initial training that qualifies a student to a certain knowledge and skill level required before the student can take additional, more advanced training.

In-Process Review (IPR). (a) A joint meeting between the Government and contractor personnel to review program status; a periodic evaluation or assessment held at a specific point in the stages of contractual work. (b) A scheduled formative evaluation conducted during or at completion of the different production sequences to ensure that the product or development process meets the acquisition requirements.

Institutional Training. Individual training conducted in a school or training center of a centralized training organization.

Instruction. (a) The delivery of information to enable learning. (b) The process by which knowledge and skills are transferred to students. Instruction applies to both training and education.

Instructional Aid Equipment. See **Training Aid Equipment.**

Instructional Conditions. (a) The instructional atmosphere including environmental, physical, and psychological factors. (b) The amount of participation which the instruction requires of the trainee. Instructional conditions may be active (the trainee produces or practices) or passive (the trainee sits and listens).

Instructional Design. The philosophy, methodology, and approach used to deliver information. Some interactive courseware aspects include question strategy, level of interaction, reinforcement, and branching complexity.

Instructional Material. All items of material prepared, procured, and used in a course or program as part of the teaching or general learning process.

Instructional Media. The means used to present information to the trainee.

Instructional Module. A self-contained instructional unit that includes one or more learning objectives, appropriate learning materials and methods, and associated criterion-referenced measures.

Instructional Program. A course of study designed and validated within the context of an approved ISD model that meets a training requirement.

Instructional Requirements. The knowledge, skills, and attitudes that are necessary to satisfy job performance.

Instructional Setting. The location and physical characteristics of the area in which instruction takes place. The setting can be in a classroom, laboratory, field, or workplace. An example is a clean, well-lighted, temperature-controlled classroom equipped with individual desks, chairs, and video monitors.

Instructional Software. The actual instructional presentation including both content and technique delivered by a computer-driven system.

Instructional Strategy. The general concept and methodology by which instruction is to be delivered to the student. Methodologies include tutorial, drill and practice, simulation, and gaming.

Instructional Support. Learning resources; different kinds of material, number of instructors, amount of time, and other resources, that will contribute to completion of the learning process.

Instructional System. An integrated combination of resources (students, instructors, materials, equipment, and facilities), techniques, and procedures performing effectively and efficiently the functions required to achieve specified learning objectives.

Instructional System Developer. A person who is knowledgeable of the instructional system development (ISD) process and is involved in the analysis, design, development, implementation, and evaluation of instructional systems. Also called Instructional Designer, Instructional Developer, Curriculum Developer, Curriculum Development Manager, and other terms.

Instructional System Development (ISD). A deliberate and orderly, but flexible, process for planning, developing, implementing, and managing instructional systems. ISD ensures that personnel are taught in a cost-efficient way the skills, knowledge, and attitudes essential for successful job performance.

Instructional Technology. (a) The study of instruction and its techniques for the purpose of enhancing its systematic organization and dependability. (b) A systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and non-human resources to bring about more effective instruction.

Instructor. An individual, military or civilian, tasked with teaching.

Integrated Logistic Support (ILS). A disciplined approach to the activities necessary to: (1) Cause support considerations to be integrated into system and equipment design; (2) Develop support requirements that are consistently related to design and to each other; (3) Acquire the required support; and (4) Provide the required support during the operational phase at minimum cost.

Integrated Manpower, Personnel and Comprehensive Training and Safety (IMPACTS). The Headquarters US Air Force/Manpower and Organization-sponsored acquisition management program that implements the specific Human Systems Integration policy outlined in DODI 5000.2. It impacts a comprehensive management and technical approach for addressing the human-centered elements of manpower, personnel, training, safety, health hazards, and human factors engineering in the acquisition of new or improved systems.

Interactive Courseware (ICW). Computer-controlled training designed to allow the student to interact with the learning environment through input devices such as keyboards and light pens. The student's decisions and inputs to the computer determine the level, order, and pace of instructional delivery, and forms of visual and aural outputs.

Interactive Learning. Instruction characterized by an interchange between the user and the material. The user learns the instruction through this interchange with the material.

Interactive Media. (a) Media that involve the viewer as a source of input to determine the content and duration of a message, permitting individualized program material. (b) A philosophy of media production designed to take maximum advantage of random access, computer- or equipment-controlled videotape and videodisc players.

Interactive Training System. An instructional system that requires a student to interact with it through the learning process.

Interactive Video. Video that uses analog and digital databases to present instructional material in the ICW environment.

Internal Evaluation. The acquisition and analysis of feedback and management data from within the formal training environment to assess the effectiveness of the instructional system. Also see **Operational Evaluation.**

Interpretation. A sub-level of the comprehension level of learning in which students develop sufficient understanding to see relationships between various aspects of a communication and are able to perform such activities as inferences, generalizations, and summations.

Introduction. A major section of a lesson designed to: (1) establish a common ground between the presenter and students; (2) capture and hold attention; (3) outline the lesson and relate it to the overall course; (4) point out benefits to the student; and (5) lead the student into the body of the lesson. The introduction segment usually contains attention step, motivation step, and overview. It covers the course content, the target population, the reason that the student is studying the material, and appropriate motivation to gain the student's attention.

Job. The duties, tasks, and task elements performed by an individual. The job is the basic unit used in carrying out the personnel actions of selection, training, classification, and assignment.

Job Aid. A checklist, procedural guide, decision table, worksheet, algorithm, or other device used by a job incumbent to aid in task performance. Job aids reduce the amount of information that personnel must recall or retain.

Job Analysis. The basic method used to obtain salient facts about a job, involving observation of workers, conversations with those who know the job, analysis questionnaires completed by job incumbents, or study of documents involved in performance of the job.

Job Performance Requirements (JPR). The tasks required of the human component of a system, the conditions under which these tasks must be performed, and the quality standards for acceptable performance. JPRs describe what people must do to perform their jobs.

Job Performance Test. A test used to determine whether or how well an individual can perform a job. It may include all job performance measures for a job or a subset of the job performance measures. Also see **Performance Test**.

Job Task Analysis. A process of examining a specific job to identify all the duties and tasks that are performed by the job incumbent at a given skill level. Also called **Task Analysis.**

Job Task Inventory. (a) The results of information gathering in job analysis. (b) Lists of duties and tasks, varying in refinement from basic input data to duties and tasks,

which constitute the job performed by incumbents within an Air Force Specialty Code (AFSC). Also called **Task Inventory.**

Joint School or Course. A school or course used by two or more military services that has a joint faculty and an appointed director (commandant) who is responsible, under the direction of the Joint Chiefs of Staff, for developing and administering the curriculum.

Knowledge. Use of the mental processes that enable a person to recall facts, identify concepts, apply rules or principles, solve problems, and think creatively. Knowledge is not directly observable. A person manifests knowledge through performing associated overt activities. Also see **Attitude** and **Skill.**

Knowledge-Level Summary. A reiteration of key points of content in a knowledge-level lesson designed to enhance a student's ability to remember facts.

Knowledge of Results. Feedback information provided to the student indicating the correctness of the response.

Learning. A change in the behavior of the student as a result of stimulus or experience. The behavior can be physical and overt, or it can be intellectual or attitudinal.

Learning Analysis. A procedure to identify task sub-elements and the related skills/knowledge that must be learned before a person can achieve mastery of the task.

Learning Hierarchy. A graphic display of the relationships among tasks in which some tasks must be mastered before others can be learned.

Learning Objective. A statement of the behavior or performance expected of a trainee as a result of a learning experience, expressed in terms of the behavior, the conditions under which it is to be exhibited, and the standards to which it will be performed or demonstrated. Also called **Behavioral Objective** or **Training Objective**. Also see **Objective**.

Lesson. (a) A segment of instruction that contains an objective, information (to be imparted to the student), and an evaluation instrument (test). (b) A segment of instruction that covers a specific maintenance task, procedure, or idea. (c) That element of a module that is designed to teach one or more learning objectives. Also see **Course** and **Module**.

Lesson Guide. An organized outline of a single lesson topic taken from the course of study and serving as a blueprint of what is to be accomplished in class. It is complete in detail and states all objectives, topics, subtopics, references, training aids, methods,

procedures, and other supplemental information as needed. In general, the lesson guide is the formal lesson plan.

Lesson Plan. An approved plan for instruction that provides specific definition and direction to the instructor on learning objectives, equipment, instructional media material requirements, and conduct of training. Lesson plans are the principal component of curriculum materials in that they sequence the presentation of learning experiences and program the use of supporting instructional material.

Life Cycle Management. The process of administering a system from the time it is initially developed until it is terminated, with emphasis on strengthening early decisions that shape costs and effectiveness.

Logistic Support. Resources required supporting instructional delivery.

Logistic Support Analysis (LSA). The selective application of scientific and engineering efforts undertaken during the acquisition process, as part of the system engineering and design process, to assist in complying with supportability and other integrated logistic support (ILS) objectives. LSA task descriptions and data item descriptions are prescribed by MIL-STD-1388-1.

Maintenance Trainer. A training device designed to train maintenance personnel on specification systems or subsystems.

Maintenance Training Simulator. A device, usually computer-controlled, that simulates operational equipment and allows trainees to practice maintenance tasks or procedures.

Major Command (MAJCOM). A major subdivision of the Air Force that is assigned a major part of the Air Force mission. MAJCOMs report directly to Headquarters US Air Force.

Management. The practice of directing or controlling all aspects of the instructional system.

Management Information System (MIS). A system that includes training databases/database networks for the management of training-related data. The database may encompass an organization’s administration of personnel training data, training resource data, and training research data.

Management Materials. Materials that define training requirements and provide an overall plan for the accomplishment of these requirements.

Management Plan. A program for the assignment, monitoring, and assessment of the personnel, materials, and resources dedicated to a specific mission, operation, or function.

Manning. The specific inventory of people at an activity in terms of numbers, grades, and occupational groups.

Manpower. The requirements or authorizations needed in an organization to accomplish a task or service. Also see **Personnel**.

Master Schedule. A schedule of instruction, prepared by the training activity, to indicate the period-by-period program for each day and week of the course.

Measurement Process. The operations involved in determining the amount of an attribute (for example, skill, knowledge, or attribute) possessed by a student.

Media. The delivery vehicle for presenting instructional material or basic communication stimuli to a student to induce learning. Examples are instructors, textbooks, slides, and interactive courseware (ICW).

Media Alternative. A substitute means for presenting materials.

Media Analysis. The process of examining media requirements and assembling a data bank of information to use for selecting appropriate media for use in instruction.

Media Mix. A combination of different media used to present a unit of instruction.

Media Selection. The process of selecting the most effective means of delivering instruction.

Memorandum of Understanding (MOU). A jointly prepared and authenticated document between participants in a joint project. Also called Memorandum of Agreement (MOA).

Method of Instruction. The means, techniques, procedures, and other provisions for the delivery of instruction. There are many appropriate methods. Included may be such processes as lecture, recitation, laboratory, examination, study periods, demonstration, use of training aids, group discussion, role playing, case studies, programmed instruction, and coach and pupil methods.

Milestone. A major point in the development of a project.

Military Standard (MIL-STD). Documents issued within the Department of Defense in accordance with the basic policy of the Defense Standardization Program (MIL-STD-962). MIL-STDs establishes engineering and technical requirements for items,

equipment, processes, procedures, practices and methods that have been adopted as standards. For military training programs, see MIL-HDBK-29612.

Mission Analysis. A process of reviewing mission requirements, developing collective task statements, and arranging the collective tasks in a hierarchical relationship.

Mission Trainer. A trainer that provides the trainees with a simulated warfare environment that is specifically mission-oriented to the type of weapon system involved. The trainer can provide specific weapon system operator modes or a mission mode that requires tactical decision-making. Does not include pilot or copilot flight dynamics training.

Mobile Training Set (MTS). A portable set of system training equipment, consisting of trainers, training aids, operational equipment, bench training sets, support equipment, technical publications, computer software, standard Air Force material, audiovisual products, and audiovisual equipment designed primarily for use by Air Education and Training Command for on-site training of maintenance personnel in field training programs.

Mobile Training Team (MTT). Any group of personnel and training equipment gathered together to provide instruction on a subject or in an area of endeavor, available for movement from place to place in order to provide instruction at the various locations concerned.

Mockup. A three-dimensional training aid designed to represent operational equipment. It may be a scaled or cutaway model and may be capable of disassembly or operational simulation.

Mode of Instruction. A method of scheduling materials presentation. The instructional mode may be individualized, self-paced, or group.

Module. (a) A stand-alone instructional unit designed to satisfy one or more learning objectives. (b) A separate component complete within itself which can be taught, measured, and evaluated for a change or bypassed as a whole; one which is interchangeable with others, used for assembly into units of differing size, complexity, or function. (c) An individualized self-instructional package, usually containing all the necessary materials a student needs to meet some or all of a learning objective/task. A module consists of one or more lessons. Also see **Course** and **Lesson**.

Motivational Device. A design element that arouses and sustains interest or regulates activity for the purpose of causing the student to perform in a desired way.

Multimedia. The use of more than one medium to convey the content of instruction. Media available for use may include, but need not be limited to: text, programmed instruction, audio and video tapes/discs, slides, film, television, and computers.

Needs Analysis. The systematic, in-depth analysis and verification of training discrepancies identified by a needs assessment, the results of which are the definition of performance deficiencies and the isolation of potential solutions; integral to front-end analysis. This analytical process addresses the specific nature of the deficiency.

Needs Assessment. (a) The systematic process for identifying the causes of discrepancies between what exists and what is currently required, and for identifying the causes of potential discrepancies between current and future requirements. (b) The process in which performance discrepancies are focused upon to determine where the discrepancies exist (for example, environmental, training, instruction, personnel, and equipment).

Objective. A statement that specifies precisely what behavior is to be exhibited, the conditions under which behavior will be accomplished, and the minimum standard of performance. Objectives describe only the behaviors that directly lead to or specifically satisfy a job performance requirement. An objective is a statement of instructional intent. Also see **Learning Objective**.

Objectivity. (a) A characteristic of evaluation, which requires that measurement in an educational environment be correct, factual, and free from instructor bias. (b) The degree to which something is evaluated the same by two or more evaluators acting independently. (c) In testing, the degree to which a test is scored the same by two or more scorers acting independently.

Occupational Analysis. Data interpretation regarding an occupational designator (Air Force Specialty Code) to determine what jobs are performed within the occupation and which tasks are performed within these jobs. Occupational analysis may be used to assess the accuracy of classification and training documents.

Office of Primary Responsibility (OPR). The office or person that serves as the primary point of contact and is responsible for a contract or a project.
On-the-Job Training (OJT). Individual training in designated job skills provided to individual members when serving in job positions in operational units.

Operating Command. The command primarily operating a system, subsystem, or item of equipment; generally, an operational command or organization designated by Headquarters US Air Force to conduct or participate in operations or operational testing.

Operational Evaluation. The process of internal and external review of system elements, system requirements, instructional methods, courseware, tests, and process guide revision as needed to enhance the continued training effectiveness and efficiency of the training system during full-scale operations. The process begins at the training system readiness review and continues throughout the life of the training

system. It includes **Internal Evaluation** and **External Evaluation.** Also see **Evaluation.**

Operational Training. Training that exercises previously acquired functional knowledge and system employment (operational) skills, to enhance proficiency and to identify deficiencies within a systematic training structure in the operational environment or in the simulated operational environment such as at a trainer.

Operator Trainer. A trainer on which students learn the methods and procedures necessary to operate specific equipment (for example, radar trainer, operational flight trainer).

Operator Training. Instruction in which students are taught the methods, procedures, and skills necessary to manipulate the controls of specific systems and equipment.

Overview. (a) A description of content, basic structures, learning objectives, and other fundamentals of the next portion of interactive courseware to be presented. (b) A segment of a lesson introduction in which the presenter provides a clear and concise presentation of the objective, the key ideas or main points of the lesson, and an indication of the teaching method to be employed.

Participating Command. A command or agency designated by the Air Force Acquisition Executive to advise the program manager and to take an active part in the development of a weapon system. The supporting command is also a participating command.

Part-Task Trainer (PTT). Operator trainers that allow selected aspects of a task (fuel system operation, hydraulic system operation, radar operation, etc.) to be practiced and a high degree of skill to be developed independently of other elements of the task.

Part-Task Training. Subordinate skills training (operations/procedures) that resembles portions, or subtasks, and response of the actual system operation. A type of two-dimensional simulation.

Part-Task Training Device. A device that permits selected aspects of a task to be practiced independently of other elements of the task. Its purpose is to provide economical training on certain elements that require special practice but are not dependent upon the total equipment.

Performance. Part of a criterion objective that describes the observable student behavior (or the product of that behavior) that is acceptable to the instructor as proof that learning has occurred.

Performance Evaluation. A process of data collection and analysis to determine the success of students on a specific individual or collective task as a result of a training program.

Performance Evaluation Tools. Competency tests that allow the trainer to profile the student's proficiency and identify weak areas so that training can be efficiently planned for the areas of most critical need.

Performance Exercise. A proficiency (criterion-referenced) test used to evaluate mastery of a task as specified by the criterion-referenced objective.

Performance Gap. An operationally significant discrepancy between design effectiveness and actual effectiveness indicative of system performance ineffectiveness. A performance gap is indicative of training subsystem, hardware subsystem, trainee characteristics, trainer characteristics, and training environment problems that must be identified and corrected.

Performance Objective. A precise statement of the performance expected of a trainee as the result of instruction, expressed in terms of the standards to which it will be performed or demonstrated. Also see **Objective**.

Performance-Oriented Training. (a) Training that emphasizes the skills and knowledge needed to perform a task or job through individual practice and constant evaluation. (b) The conduct of individual or collective training in which one or more tasks are performed under specified conditions to a specified standard. It differs from traditional practical exercises in that performance is measured against a specific standard. Also see **Criterion-Referenced Instruction**.

Performance Requirements. The separate acts that are required to satisfactorily complete an individual's performance on the job. These include the act (behavior), the conditions under which the behavior is performed, and the standard of performance required by the incumbent.

Performance Test. (a) A sample work situation that tests how well the student has mastered the psychomotor and cognitive skills required for job performance. (b) A test in which the performance of a task is the criterion of skill mastery. Such a test is prepared in terms of the specific task to be performed, the conditions under which it will be performed, and the absolute standards for acceptable performance. (c) A test that measures the skills and knowledge needed to perform the terminal learning objectives against specific standards. For some circumstances, this could be a written test if designed as a job sample for personnel whose responsibilities involve only paper procedures. Also see **Proficiency Test.**

Personnel. The individuals who accomplish specific tasks. Personnel connote individuals, whereas manpower connotes requirements or authorizations. Also see **Manpower**.

Phased Approach. A process whereby training capability of a training system and its components are incrementally fielded based on user training need and required assets available, ready for training and initial operational capability dates, maturity of the weapon system and associated tactics, and capability to provide logistical support.

Physical Fidelity. The degree of structural or dynamic correspondence of a training device to the operational system/equipment it represents.

Pilot Course. A full-length course conducted in a target environment (facilities, instructors and trainees) using the curriculum and supporting training material prepared for that course. It has as its purpose the "shaking down" or "validating" of the curriculum and materials in a classroom situation to determine their effectiveness in attaining the approved learning objectives or training goals.

Pipeline. The total time involved in training personnel once they are designated as trainees. It includes time traveling to the training activity, time awaiting instruction, time of actual training, time from termination of training until reporting to the ultimate duty station, and possibly more than one training activity.

Plan of Instruction (POI). A qualitative course control document designed for use primarily within a school for course planning, organization, and operation. Generally, criterion objectives, duration of instruction, support materials, and guidance factors are listed for every block of instruction within a course. Also called **Syllabus.**

Plans. Documents developed and revised throughout the ISD process detailing requirements, operating goals, and procedures.

Posttest. A test administered to a student upon completion of a course or unit of instruction to measure learning achieved and to assess whether a student has mastered the objectives of the course or unit of instruction.

Prerequisite Training. The training that personnel must have previously completed successfully in order to be qualified for entry into training for which they are now being considered.

Presentation Media. Different media used to convey or communicate information to individuals engaged in learning. These media may include printed materials, audiovisual devices, hardware simulators, or stimulators.

Pretest. A test administered to a student prior to entry into a course or unit of instruction to determine the technical skills (entering behaviors) the student already

possesses in a given subject. Pretests are often used to identify portions of instruction that the student can bypass.

Proficiency. A specific standard of performance in which the trainee demonstrates a predetermined skill ability or expertise.

Proficiency Test. A test designed to measure a trainee's capabilities in terms of the job. It measures both psychomotor and cognitive skills. A performance test is sometimes understood to mean a skill demonstration, while a proficiency test is understood to be a comprehensive procedure used to examine the trainee's capability to do what the job requires. Also see **Performance Test.**

Proficiency Training. (a) Training conducted to improve or maintain the capability of individuals and teams to perform in a specified manner. (b) Training to develop and maintain a given level of skill in the individual or team performance of a particular task.

Program Evaluation Review Technique (PERT). (a) A visual representation of the tasks of a project, showing the relationship between the tasks and defining the critical path. (b) A planning technique that arranges events and their duration into a flow graph to examine the entire program and to aid in decision making on sequencing priorities, total time for plan completion, preparation (lead) time for specific events, and other determinations.

Program Management Responsibility Transfer (PMRT). The transfer of program management responsibility for a system (by series) or equipment (by designation) from the implementing command to the supporting command.

Programmed Instruction. A student-centered method of instruction that presents the information in planned steps or increments, with an appropriate response immediately follows each step. The student is guided step-by-step to the successful completion of the assigned task or training exercise.

Project Officer (PO). The operating command coordinator at a site assigned to ensure that AF activities and the contractor have a central point of contact for contract administration, logistic support, and security support as determined from the contract. PO duties can be assigned to personnel within the organization or to the Quality Assurance Representative.

Quality Air Force (QAF). A management philosophy and a methodology that work together to produce continuous process improvements. QAF implements Total Quality Management (TQM) in the Air Force. Also see **Total Quality Management.**

Quality Assurance (QA). Actions taken by the Government to assure that services meet the requirements in the Statement of Work (SOW).

Quality Assurance Representative (QAR). The person responsible for checking and evaluating contractor performance.

Quality Improvement (QI). The organized creation of beneficial change; improvements made in products, procedures, learning, etc.

Ready for Training (RFT). The dates on which sufficient equipment, training capabilities, personnel, and logistics elements are available to support full operational training.

Ready for Use (RFU). The date on which the training system can be used for productive training.

Reliability. (a) A characteristic of evaluation which requires that testing instruments yield consistent results. (b) The degree to which a test instrument can be expected to yield the same result upon repeated administration to the same population. (c) The capability of a device, equipment, or system to operate effectively for a period of time without a failure or breakdown.

Required Assets Available (RAA). The date agreed to by the operating command and Headquarters Air Force Materiel Command when sufficient equipment, personnel, and logistics elements will be available to the operational command to begin a trial period for equipment operation and support capability before initial operational capability. Logistics elements include approved operational support equipment, critical spares, verified technical manuals, and training programs and courses.

Required Delivery Date (RDD). The date on which items are needed.

Resident Training Course. A course conducted at a training location (such as a training center) where the trainee is a full-time student, as compared to training conducted at the trainee's duty location.

Resource Requirements List. An overall list that identifies the texts, references, equipment, films, graphics, and instructional media materials required to support the curriculum.

Sample of Behavior. Student behavior which the instructor will accept as evidence of learning. The specific behavior in each sample is the variable; the taxonomy level (cognitive, affective, or psychomotor) of the set of samples is the constant and serves as the common denominator of each sample. Also called **Behavior Indicator.**

Self-Paced Instruction. Instruction that permits progress at the individual student's own desired rate of learning. Also see **Individualized Instruction.**

Self-Study. Individual study on the job site or duty location.

Self-Study Workbook/Guide. (a) A document containing a series of lessons arranged in discrete steps with self-test questions that allow the instructor to monitor the students' progress. It is used to guide the student through a controlled path of study and specific job tasks with a minimum amount of supervision. (b) An instructional document that provides the student study material in support of objectives. This document contains the objectives, sub-objectives, subject matter content, reference to adjunct reading or study material, review exercises with feedback, and directions to interact with training media including an instructor.

Simulation. A technique whereby job environment phenomena are mimicked, in an often low-fidelity situation, in which costs may be reduced, potential dangers eliminated, and time compressed. The simulation may focus on a small subset of the features of the actual job environment.

Simulator. (a) Hardware and software designed or modified exclusively for training purposes involving simulation or stimulation in its construction or operation to demonstrate or illustrate a concept or simulate an operational circumstance or environment. Training simulators and devices are considered part of the overall training system that may or may not be identified as part of the parent defense system. (b) Training equipment that imitates operational equipment both physically and functionally, such as a cockpit procedures trainer, operational flight trainer, or weapon systems trainer. Also see **Training Device.**

Simulator Certification (SIMCERT). The process of ensuring through validation of hardware and software baselines that a training system and its components provide the capability to train personnel to do specific tasks. The process ensures that the device continues to perform to the delivered specifications, performance criteria, and configuration levels. It will also set up an audit trail regarding specification and baseline data for compliance and subsequent contract solicitation or device modification.

Skill. The ability to perform a job-related activity that contributes to the effective performance of a task. Skills involve physical or manipulative activities that often require knowledge for their execution. All skills are actions having specific requirements for speed, accuracy, or coordination. Also see **Attitude** and **Knowledge.**

Skill Level. (a) A list of proficiency requirements for performance of a specific job. (b) The level of proficiency at which an individual qualifies in that occupational specialty.

Small-Group Tryout. Tryout of a training course on a representative sample of the target population to gather data on the effectiveness of instruction in regard to error rates, criterion test performance, and time to complete the course. Also see **Field Test** and **Field Validation.**

Software. (a) The programs and routines that tell the computer and its peripherals what to do; any system of instructions that direct computer operation; a category of computer components restricted to instructions to the equipment (hardware); the programs for the computer. Typically, software can be divided into operating systems, computer languages including authoring tools, and application programs. (b) The media that store software, such as floppy disks, flowcharts, manuals, and other computer programming documentation. (c) Non-equipment training material, such as pamphlets, handouts, schematics, charts, audiovisual products, and guide sheets.

Source Data Integrity Program. A program designed to ensure that timely, quality military standard baseline source data is provided by the defense system developer to the training system or component developer throughout the life cycle of the system.

Specialty Training Standard (STS). A standard that identifies the most common tasks of an enlisted Air Force Specialty (AFS) that requires training.

Specification. A document prepared specifically to support acquisition, which clearly and accurately describes essential technical requirements for purchasing material. Procedures necessary to determine that the requirements for the materials covered by the specification have been met are also included. Military specifications are documents issued within the Department of Defense in accordance with the basic policy of the Defense Standardization Program. A military specification covers systems, subsystems, components, items, materials, or products that are intrinsically military in character or are used in, or in support of, weapons systems and involve an essential system function of interface (see MIL-STD-961).

Standard. A document that establishes engineering and technical requirements for items, equipment, processes, procedures, practices, and methods that have been adopted as standard. Standards may also establish requirements for selection, application, and design criteria for material. Military standards are documents issued within the Department of Defense in accordance with the basic policy of the Defense Standardization Program (see MIL-STD-962).

Standard of Performance. A statement that establishes criteria for how well a task or learning objective must be performed. The standard specifies how well, completely or accurately a process must be performed or a product produced. The standard reflects task requirements on the job or learning requirements in the classroom. A product standard is expressed in terms of accuracy, tolerance, completeness, format, clarity, errors, or quantity. A process standard is expressed in terms of sequence, completeness, accuracy, or speed. Both product and process must be observable and measurable. Also see **Standards Statement**.

Standards Statement. A part of a criterion objective that describes the qualitative and quantitative criteria against which student performance or the product of that performance will be measured to determine successful learning. Also see **Standard of Performance**.

Statement of Work (SOW). A document that establishes and defines all non-specification requirements for contractor efforts, either directly or with the use of specific cited documents.

Stimulation. The process whereby operational equipment can be artificially induced to replicate the operational environment to exploit additional training capabilities of the weapon system.

Storyboard. A layout with detailed graphic description of a single frame or series of frames, arranged sequentially, that describes the action and content of a visual medium of instruction in interactive courseware (ICW). A storyboard specifies all details such as graphics, text, visuals, video, audio, and special effects. It is a graphic depiction that visually shows the courseware presentation.

Strategy. The logical arrangement of course content within a pattern or organization that will likely cause the most learning to occur. It includes the purpose, target audience, content outline, level of interaction, feedback, testing, audiovisual options, and other data.

Student. The individual being trained, the individual learning from the course, or an individual who has been placed in a learning situation in order to acquire knowledge and skills required for accomplishment of specific tasks. Also called **Trainee.**

Student Guide. (a) A generic term for the various printed materials developed for student use. (b) A publication that provides each student with the supplementary material (in addition to technical manuals) judged to be required for successful completion of a course of study.

Subject Matter Expert (SME). (a) An individual who has thorough knowledge of a job, duties/tasks, or a particular topic, which qualifies him/her to assist in the training development process (for example, to consult, review, analyze, advise, or critique). (b) A person who has high-level knowledge and skill in the performance of a job. Also see **Expert Opinion**.

Summary. A segment of a lesson conclusion during which the presenter reiterates key points of lesson content (knowledge level) or reviews and expands on key material and develops relationships that lead to generalizations (comprehension level).

Summative Evaluation. The overall assessment of a program at the completion of the developmental process. It is designed and used after the instructional system has become operational. Also see **Evaluation.**

Support Equipment. All equipment required to perform the support function except that which is an integral part of mission equipment. Does not include any equipment required to perform mission operations functions.

Supporting Command. The command (usually Headquarters Air Force Materiel Command) responsible for providing logistics support for a system and assuming program management responsibility from the implementing command.

Supportive Relationship. In instructional systems development, skills and knowledge in one learning objective which have some relationship to those in another learning objective. The learning involved in mastery of one learning objective transfers to the other, making learning involved in the mastery of the other easier.

Surveillance. A process that provides ongoing evaluation of training or training materials to ensure continued effectiveness and currency of content to meet the training requirements as dictated by the operational systems, support systems, mission, and threats.

Syllabus. See **Plan of Instruction**.

System. A composite of skilled people and equipment (hardware and software) that provides an operational capability to perform a stated mission.

System Engineering Management Plan (SEMP). Typically the most important plan in a training acquisition. The SEMP covers the entire system engineering process and includes integration of internal processes and interfaces with external processes.

System Training Plan (STP). The specific document that includes program information and data concerning the system or equipment program, event, or situation that originated the training requirement, and describes the training required and the training programs to satisfy the requirement. The STP is designed to provide for planning and implementation of training and to ensure that all resources and supporting actions required for establishment and support are considered.

System Engineering Process. A logical sequence of activities and decisions transforming an operational need into a description of system performance parameters and a preferred system configuration.

Tailoring of Data Requirements. The deletion of data requirements, from an approved Data Item Description (DID) or source document, that are unnecessary to meet the needs of a specific contract.

Task. A unit of work activity or operation which forms a significant part of a duty. A task usually has clear beginning and ending points and directly observable or otherwise measurable processes, frequently but not always resulting in a product that can be evaluated for quantity, quality, accuracy, or fitness in the work environment. A task is performed for its own sake; that is, it is not dependent upon other tasks, although it may fall in a sequence with other tasks in a duty or job array.

Task Analysis. See **Job Task Analysis** and **Training Task Analysis.**

Task Description. A verbal description in column, outline, decision table, or timeline format that describes the required job behavior at the highest level of generality. It is intended to provide an overview of the total performance.

Task Description Worksheet. A tool used to document specific task factors including training factors, stimuli, subtasks, steps and activities, standards of performance, and job aids.

Task Fidelity. The degree of correspondence of cues and responses accompanying task performance on a training device to those characteristics of analogous performance on the operational system/equipment.

Task Inventory. See **Job Task Inventory.**

Task Statement. A written description of task performance that contains an action verb and an object, and must express the conditions under which the task is performed and the standard that the performance must meet.

Taxonomy. A system for categorizing things in a hierarchical order.

Taxonomy of Educational Objectives. A systematic classification scheme for sorting learning outcomes into three broad categories (cognitive, affective, and psychomotor) and rank-ordering these outcomes in a developmental hierarchy from least complex to most complex.

Technical Data. Recorded information, regardless of forms or characteristics, of a scientific or technical nature. It may, for example, document research, experimental, developmental, or engineering work. It may be used to define a design or process or to acquire, support, maintain or operate material. The data may be graphic or pictorial delineations in media such as drawings or photographs, text in specifications, related performance or design-type documents, or computer printouts. For purposes of this handbook, technical data includes research and engineering data, engineering drawings and associated lists, specifications, standards, process sheets, technical reports, catalog item identifications and related information, documentation related to computer software, and computer-generated databases. Technical data does not include computer software or financial, administrative, cost and pricing, and management data, or other information incidental to contract administration.

Technical Manual (TM). A publication that contains instructions for the installation, operation, maintenance, training, and support of a weapon system, weapons system component, and support equipment. TM information may be presented in any form or characteristic, including but not limited to hard printed copy, audio and visual displays,

magnetic tape, discs, and other electronic devices. TMs normally include operational and maintenance instructions, parts list or part breakdowns, and related technical information or procedures exclusive of administrative procedures.

Technical Training. Training in specific skills and knowledge essential to performance of those tasks and duties related to a technical specialty.

Terminal Behavior. The output performance for a system; graduate performance.

Terminal Objective. A learning objective describing what is expected of the trainee upon completion of a lesson, topic, major portion of a course, or course completion. Also called Terminal Learning Objective.

Test. Any device or technique used to measure the performance, skill level, and knowledge of an individual.

Test Fidelity. The degree to which the test resembles the actual task performed. The closer the resemblance, the higher the fidelity of the test.

Topic. The basic organizational unit of instruction covering one or more closely related learning objectives.

Topical Outline. An outline of the topics to be included in the instructor guide. It provides course learning objectives, a listing of part, section, and topic titles, and statements of rationale to explain or justify the training. It is used by the curriculum designer to develop the instructor guides.

Total Contract Training (TCT). A training concept that includes contract support for a contractor- operated training system. It includes instructors, curriculum, courseware, facilities, trainers, aircraft, spares, support equipment, and other support elements of contractor logistics support. The purpose of a TCT is to produce a trained student.

Total Quality Management (TQM). The philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. TQM is the application of quantitative methods and human resources to improve the material and services supplied to an organization, all the processes within an organization, and the degree to which the needs of the customer are met, now and in the future. TQM integrates fundamental techniques, existing improvement efforts, and technical tools under a disciplined approach focused on continuous improvement. TQM is implemented in the Air Force by the Quality Air Force (QAF) program. Also see **Quality Air Force.**

Trainee. See **Student**.

Training. Instruction and applied exercises presented in a structured or planned manner, through one or more media, for the acquisition and retention of skills, knowledge, and attitudes required to meet job performance requirements. It includes **Collective Training**; **Individual Training**; **Institutional Training**; **On-The-Job Training**; and **Unit Training.**

Training Agency. An office, command, or headquarters exercising command of and providing support to some major portion of a formalized training effort.

Training Aid. Any item that is developed and/or procured with the primary intent that it will assist in training and the process of learning.

Training Aid Equipment. Logistic support equipment that is used to display training aids but which is not itself the subject of instruction. It includes items such as motion picture projectors, slide projectors, tape recorders and playback units, sound film readers, record players, sound/slide projectors, overhead projectors, and opaque projectors. It also includes secondary items such as easels and projector stands. Also called **Instructional Aid Equipment.**

Training Concept. Statement of how the required training is to be accomplished in terms of type of training, presentation environment, presentation techniques, presentation media, pipeline, location, and other considerations.

Training Device. Hardware and software designed or modified exclusively for training purposes involving simulation or stimulation in its construction or operation to demonstrate or illustrate a concept or simulate an operational circumstance or environment. Also see **Simulator**.

Training Effectiveness. (a) The training benefit gained in terms of operational readiness. (b) The thoroughness with which training objectives have been achieved, regardless of training efficiency. Also see **Training Efficiency.**

Training Efficiency. (a) The extent to which training resources (including time) are used economically while achieving training effectiveness. (b) Resource investments required to achieve specific training objectives or requirements. Resources may include time, instructor assets, training device assets, equipment assets, and costs. Training efficiency is directly related to training effectiveness. There can be no efficiency if there is no effectiveness, because effectiveness implies a benefit from the resources invested. Also see **Training Effectiveness**.

Training Effort. (a) The sum of actions taken to establish and operate training activities, provide training programs, or otherwise contribute positively to the overall posture of training. (b) The man-hours and dollars expended to provide for trained personnel, training services, and instructional materials.

Training Exercise. A "practice problem" conducted in the field, for example, a simulation of the real situation (operational situation), conducted in an environment approximating the significant features of the real (operational) environment. A series of training scenarios whose purpose is to increase the level of expertise within a particular area.

Training Facility. A permanent or semi-permanent military real property or contractor property used for the purposes of conducting training.

Training Fidelity. The extent to which cue and response capabilities in training allow for the learning and practice of specific tasks so that what is learned will enhance performance of the tasks in the operational environment.

Training Management System (TMS). A set of operational tools to help training system managers in controlling and enhancing the evolution of a training system during the life cycle. Modules consist of administration, curriculum management, resource management, schedule management, performance measurement, configuration management, logistics management, and reports.

Training Materials. Plans, control documents, and instructional materials.

Training Need Date (TND). The specified date or milestone (from the requirements documentation as amended) when the training system should be ready for training.

Training Objective. See **Learning Objective**.

Training Plan. A document that includes program information and data concerning the system or equipment program, event, or situation that originated the training requirement, and describes the training required and the training program to satisfy the requirement. Training plans are designed to provide for planning and implementation of training and to ensure that all resources and supporting actions required for establishment and support are considered.

Training Planning Team (TPT). An action group composed of representatives from all pertinent functional areas, disciplines, and interests involved in the life cycle design, development, acquisition, support, modification, funding, and management of a specific defense training system. The TPT uses the system-training plan to ensure that training considerations are adequately addressed in the defense system acquisition and modification processes.

Training Program. An assembly or series of courses or other requirements that have been organized to fulfill a broad overall training objective.

Training Readiness. (a) The quality of being ready to undertake the scheduled training (that is, ready to be instructed and to benefit from the instruction). (b) The

quality of being up to date (that is, able to provide training on the very latest model, device, version, technique, information, and other essentials). (c) The capability to train (that is, having the means to train in a specified content area).

Training Requirement. The skills and knowledge that are needed to satisfy the job performance requirements and that are not already in the students' incoming repertoire.

Training Requirements Analysis. A determination of the requirements to resolve a training deficiency.

Training Resource Requirements. The training staff and student authorizations, training equipment and devices, test equipment and spare parts, training services and materials, construction for (or modification of) training facilities, technical services, and other resources necessary to conduct required training.

Training Resources. The manpower, equipment, material, facilities, funds, and other resources required for the conduct and support of training.

Training Schedule. The planned use of instructors, students, facilities and equipment within a school.

Training Site. The geographic location at which a course or training is conducted.

Training Site Selection. In training analysis and design, the decision regarding where a task should be trained (that is, resident or institution versus unit or job site).

Training Staff. The administrators and instructors assigned to a training activity.

Training Standard. (a) A quantitative or qualitative measure for the determination of a level of competence or readiness. (b) A standardized procedure or exercise.

Training Support. The providing of resources, such as authorizations, personnel, funds, facilities, hardware, course materials, and services, for use of the training activity.

Training System. A systematically developed curriculum including, but not necessarily limited to, courseware, classroom aids, training simulators and devices, operational equipment, embedded training capability, and personnel to operate, maintain, or employ a system. The training system includes all necessary elements of logistic support.

Training System Readiness Review (TSRR). The meeting between the contractor and the Air Force to support an Air Force decision on the suitability of the training system based on the results of summative evaluation.

Training System Requirements Analysis (TSRA). A systematic approach to front-end analysis of a defense system based on an integrated instructional system development or system engineering process that develops data items to document the training and preliminary system requirements.

Training System Support Center (TSSC). A consolidated function that contains the personnel, equipment, facilities, tools, and data necessary to provide life cycle hardware and software support for a training system.

Training Task. A task selected for training.

Training Task Analysis. The process of examining each unique unit of work from job task analysis to derive descriptive information (for example: procedural steps, elements, task conditions, standards, and other information) used in the design, development and testing of training products. Also called **Task Analysis.**

Training Task List (TTL). Documentation of total training tasks developed for a defense system and its respective mission. It includes the entire spectrum of tasks in each functional area (operations, maintenance and support) requiring training. The TTL provides the training task baseline for all acquisition, modification, support, management and funding actions through comparison with predecessor or future weapon systems.

Tutorial. (a) An instructional program that presents new information to the trainee in an efficient manner and provides practice exercises based on that information. (b) A lesson design used to teach an entire concept. (c) Interactive instruction that asks questions based on the information presented, requests trainee responses, and evaluates trainee responses. Tutorials are self-paced, accommodate a variety of users, and generally involve some questioning, branching, and options for review.

Unit Training. Individual or collective training conducted by an operational unit.

Upgrade Training. Training administered for the purpose of upgrading skill level.

Validation. The process of developmental testing, field testing, and revision of the instruction to be certain the instructional intent is achieved. The curriculum materials and instructional media materials are reviewed for instructional accuracy and adequacy, suitability for presentation, and effectiveness in providing for the trainees' accomplishment of the learning objectives.

Validity. The degree to which a criterion test measures what it was designed to measure.

Verification. (a) The process by which previously validated curriculum materials and instructional media materials are proved to be adequate in the actual training

environment. (b) A review of the tape, videodisc, and software to ensure that the content is correct. Verification is usually accomplished during the pilot course. The materials are revised as necessary as a result of the verification. Also see **Validation**.
Videodisc. A medium of audiovisual information storage for playback on a television monitor.

Videotape. A magnetic tape that can record and play back audio (sound) and video (pictures).

Weapon System. A combination of one or more weapons with all related equipment, materials, services, personnel, training, and means of delivery and deployment (if applicable) required for self-sufficiency. For purposes of this handbook, a weapon system is that portion of the system that conducts the mission.

Weapon System Trainer. A device that provides an artificial training/tactics environment in which operators learn, develop, improve and integrate mission skills associated with their crew position in a specific defense system.

Weapon System Training. See **Defense System Training.**

Work Sample. A sample problem representative of the job as a whole, chosen and adapted for the purpose of testing performance on important operations of the job as nearly under normal conditions as possible apart from an actual tryout on the job. Performance on a work sample is frequently used as a criterion against which prediction devices in evaluation are validated.

Workstation. A physical location containing equipment that allows a user to develop or execute interactive courseware lessons. A display console with input devices.

Attachment 2

Cross-Walk Mapping of MIL-HDBK-29612 Tasks to AFH 36-2235, Volume 3

Introduction

The chart on page 175 illustrates relationships between the major tasks of MIL-HDBK-29612 and the various activity blocks of AFH 36-2235, Volume 3. Volume 3 activity blocks are numbered across the top of the chart; MIL-HDBK-29612 tasks are numbered down the left side. Intersecting squares are shaded where one or more MIL-HDBK-29612 sub-tasks reasonably map to one or more of the Volume 3 sub-tasks.

Over 80% of all MIL-HDBK-29612 sub-tasks correlate with sub-tasks of the Volume 3 activity blocks. However, 40% of the Volume 3 sub-tasks have no MIL-HDBK-29612 coverage at all.

The chart also illustrates that the Volume 3 process groups common sub-tasks differently than the MIL-HDBK-29612 process. While some Volume 3 activities map fairly cleanly to MIL-HDBK-29612 tasks on a one-to-one basis (Activity Block 23 to Task 301, for example), other Activity Blocks map to as many as seven major tasks in MIL-HDBK-29612.

Volume 3 activity blocks

There are 33 Activity Blocks that are mapped against MIL-HDBK-29612. These are listed below. The numbers in brackets [ ] refer to the page number in Volume 3 where you may find information on the activity.

1. Evaluate Constraints and Opportunities [17]
2. Acquisition Planning [49]
3. RFP Development [54]
4. Proposal Writing [57]
5. Source Selection [59]
6. Training System Planning [61]
7. Mission and Task Analysis [73]
8. Training Requirements Analysis [76]
9. Objectives Analysis [79]
10. Media Analysis [81]
11. Cost Estimation (Analysis) [84]
12. Training System Basis Analysis [87]
13. Develop Preliminary Syllabus [90]
14. Start of Development [94]

Continued on next page

Volume 3 activity blocks (Continued)

15. Guidance Conferences [95]
16. Write Detailed System-Level Development Plans [96]
17. Courseware Planning Leading to System Requirements Review [100]
18. Development Activities Leading to System Design Review [104]
19. Development Activities Leading to Preliminary Design Review [107]
20. Development Activities Leading to Critical Design Review [110]
21. Lesson Outlines; Flow Diagrams [114]
22. Lesson Strategy Development (Lesson Plans) [116]
23. Storyboard [118]
24. Code; Program; Write [119]
25. Lesson Tests; Individual Tryouts [120]
26. Course-Level Integration (Tests) [123]
27. Small-Group Tryouts [124]
28. Iterative Remedy and Retest, Functional Configuration Audit (FCA) and Course Readiness Review (CRR) [126]
29. Site Training Readiness Review (STRR) [130]
30. Full-Class Tryouts (Large Group) [136]
31. Training System Readiness Review (TSRR) [141]
32. Mature System Performance Review [137]
33. Ongoing, Life Cycle Evaluation and Update [144]

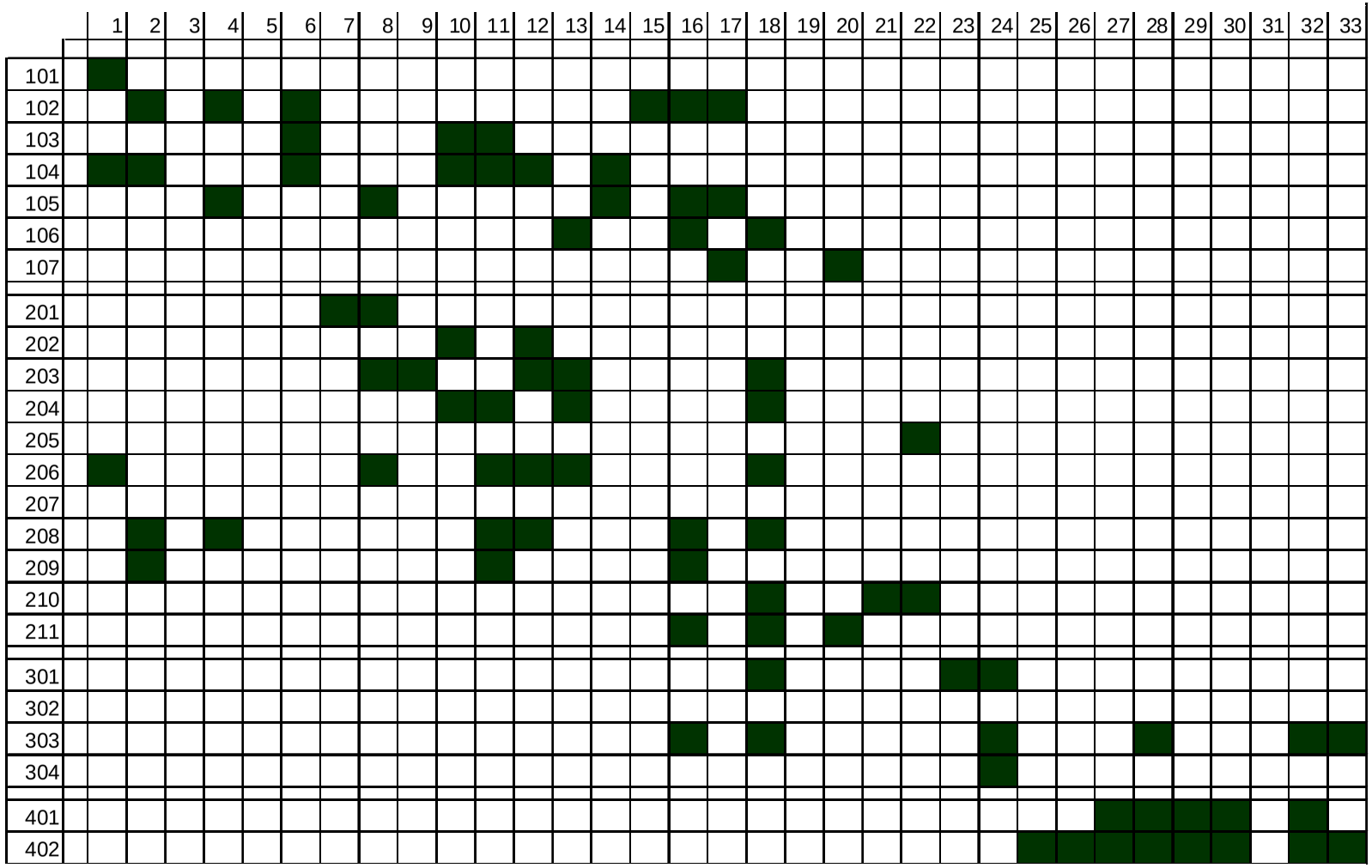
MIL-HDBK-29612 tasks

There are hundreds of tasks listed in MIL-HDBK-29612. For brevity of this handbook, they are not listed on the following chart; however, their overall task numbers are listed. You must review MIL-HDBK-29612 to understand the applicable tasks and sub-tasks. The chart on the following page will make it easier.

CROSS-WALK MAPPING

AFP 50-68 Vol. 3 Activity Block

1379D TASKS



Attachment 3

Lessons Learned

Introduction

As you progress through the ISD process in acquiring training with the acquisition of defense systems, you will ask yourself: "How can I prevent a mistake?" or "Just what do I look for?" or "Do I really have to coordinate this change?" The following lessons learned examples were extracted from actual successes and not-so-successful experiences in past Air Force programs. They are provided not only for your information, but also to serve as an introduction to the Air Force Materiel Command Lessons Learned Program. This "Program" is a database of information located at the Air Force Materiel Command (AFMC) Headquarters at Wright-Patterson AFB, Ohio. This floppy disk and hard copy data bank can pay immeasurable dividends if used properly. Call AFMC at DSN 785-3454, Commercial 513/255-3454, or write:

AFMC Lessons Learned Program
ASC/CYML
263rd Street, Building 17
Wright-Patterson AFB, OH 45433-6503

Examples

The following are examples of lessons learned:

The F-100 jet engine (used on the F-15 and F-16) was not available for training until eight years after deployment. As a result, efficient and effective maintenance was not available. (Source: AFSC/HSD.)

Operational E-3As were used as trainers because no trainers were initially purchased with the weapon system. In addition, built-in test (BIT) was eliminated without evaluating its impact on training. These two decisions resulted in costly corrective actions. In the interim, the Air Force paid $3 million a year for contract training. Had they bought the trainer on time they could have saved $9 million. (Source: Tech Report ADB099-970. April 1981, Logistics Mgmt. Inst.; also MANPRINT Bulletin Sep/Oct 88.)

The F100-AW-220-equipped F-15 aircraft at Eglin AFB in August 1988 were a success story. They had 100% serviceable spares, no holes, and plenty of combat-ready

Examples (Continued)

spare modules. Activating -220-equipped F-15 aircraft in July 1986, the 33rd TFW received their 59th aircraft in May 1988.

Throughout the 36,000-plus hours flown since that time, reliability and maintainability parameters remained at unprecedented high levels. The engine operated so well that maintaining skill proficiency levels became a problem similar to the "Maytag repairman" story. Since the engine seldom broke, there was little chance to work on it. Much of this success story was attributed to the overall strategy of strong user involvement during ASD field visits to finalize the technical data requirements and maintenance concept to starting production engine deliveries. (Source: AFSC/ASD-AL, AL Staff Digest, Aug 88.)

The GLCM program had a number of MPT-related problems:
A training system designed for 340 students per year that had to train 1400 troops per year
Inadequate field survival training
Other training-related problems
(Source: AFSC/ASD Paper, Nov 88.)

Changing scenarios for the A-10 deployment location from one base to two bases required an additional 165 personnel slots. This requirement, however, was not coordinated early enough to have trained people available for the first two overseas deployment exercises. (Source: MANPRINT Bulletin Sep/Oct 88.)

Attachment 4

374 Training Development Squadron 15-Step ISD Process

Introduction

Before you start, it's important to understand the structure of the Air Force Specialty Code (AFSC). Each AFSC is considered to be a job. Each job is completed by performing related duties; each duty is completed by performing a given number of tasks; each task is completed by performing a sequence of activities; and each activity is completed by applying skill and knowledge behaviors. By approaching acquisition training development in this manner and using the right analysis parameters, accurate and cost-effective training/TTM can be determined. Also note that results of analysis performed using this handbook may be documented by either completing forms you develop or using forms developed by the 374 TDS and provided at the end of this attachment. While these forms are not mandatory, they are provided because they have been successfully used for these procedures. You may also document data by using the ISD Automation software (IBM-compatible) titled "ISDA" available from the 374 TDS (for address, see page 259).

WARNING

If working with classified data, the media used to document the data become classified. Always check with the Program Security Officer for instructions concerning storage and disposition of media.

STEP 1
IDENTIFY SYSTEM REQUIREMENTS

Substep 1 **Identify Duties**

Purpose

The purpose of this substep is to identify and compile a list of duty statements associated with an AFSC as related to the weapon system. A list of duty statements can be assembled by referring to the “Specialty Summary” and “Duties and Responsibilities” sections of AFR 39-1, Occupational Survey Reports (OSRs), applicable specialty training standards, and contractor data. Duty statements are created from two parts of speech, a verb and an object. The verb and the object describe the duty in a broad sense.

Example

For example, one of the duties of an avionics technician might be to “Maintain the J-4 Compass System.” In this example, the verb and the object don’t tell how (remove, replace) or what (flux valve, main amplifier) to maintain. Together they simply tell technicians that they are required to keep an aircraft system in working order. Don’t hesitate to assume that some duties are required even if they’re not stated in available data sources. Use your experience as well as the experience of other SMSs. However, be sure to document all assumptions as such. You may document your data in any format you desire; just document it.

Verification

Once the list of duty statements is complete, have it verified by applicable agencies such as the using command and test force technicians. After verification, a periodic review/reevaluation should be accomplished to ensure accuracy. As the system matures, new information becomes available.

Substep 2 **Gather Data**

Purpose	The purpose of this substep is to gather all data pertaining to a given AFSC which, in turn, is related to a given weapon system. This data will eventually be used to help structure a complete task list. The complete task list is used to identify and define potential training requirements.
Limit your database	The database should be limited to data relating to entries identified in the duties list (developed in the first substep). For example, while performing ISD for an avionics system of an aircraft, data related to the engine isn't considered unless these systems interact with one another.
Additional sources	Many "new" or "advanced" systems are actually the next generation of existing equipment. Similarities may exist in operator/maintenance functions and performance requirements. Data obtained from similar systems can be used to project new job performance requirements.
Examples	Data can be collected from: User-defined operational concepts User-defined maintenance concepts PDRs CDRs LSA Maintenance Level Analysis (MLA) Contractor engineering drawings SMS/contractor engineer interviews SMS/contractor technician interviews Developmental Program Manuals (DPMs) Preliminary Technical Orders (PTOs)
Forms of data	Data can take many forms. Use any and all available data to compile as comprehensive a database as possible.
Substep 3	**Identify Tasks**

Purpose

The purpose of this substep is to identify and record a comprehensive list of task statements necessary to perform all related duties. A good task description will include a definition of what is to be done, why, when, where, by whom, and how well. The entire training scenario is built upon written task descriptions, which detail job performance requirements. Use the following criteria to identify tasks.

A task is a group of related activities directed toward a goal.
A task usually has a definite beginning and end.
A task involves a person's interaction with equipment, other personnel, and/or media.
A task, when performed, results in a meaningful product.
A task includes a mixture of decisions, perceptions, and/or motor activities.
A task may be any size or degree of complexity, but must be directed toward a specific purpose or discrete portion of the total duty.

Example

Identify the tasks for every duty statement from Substep 1. Referring to the example in Substep 1, the first task statement might be "REMOVE J-4 COMPASS SYSTEM FLUX VALVE." The verb and object describe, more specifically, how and what to maintain.

Substep 4 **Verify Task List**

Purpose

The purpose of this substep is to verify that the task list is as complete and accurate as possible. Verification requires close coordination between applicable agencies. These agencies might include other SMSs, test force counterparts, contractor personnel, or user maintenance personnel.

Verification instructions

Also, when asking for task list verification, give instructions to:

Identify additional tasks that need to be included.
Identify tasks not performed on this weapon system, but put on the list in error.
Evaluate each statement's action verb for accuracy.

Modifications	Once the task list is verified, make the necessary modifications. As with the duty list, reevaluate the task list.
Substep 5	**Group Tasks**
Purpose	The purpose of this substep is to group discrete/related tasks. Keep in mind that the way tasks are grouped may influence the design of the training equipment. Tasks that are grouped together tend to be taught together.
Logical grouping	A logical procedure for grouping tasks is to separate them by major subsystem. Tasks related to individual subsystems may be further divided according to functions performed. Finally, tasks may be subgrouped at the line/shop level within each function.

STEP 2
IDENTIFY CHARACTERISTICS OF THE TARGET POPULATION

Introduction	Before training requirements can be determined, two pieces of information are needed: (1) tasks identified in Step 1, and (2) characteristics of the target population. These characteristics are skills and knowledge that the target population already possess and are combined to create a definition of the target population.
Definition	The target population is defined based on two factors: (1) skill levels, and (2) previous training. Skill levels are simply the 3, 5, or 7 level rating of the personnel who will perform the maintenance. Previous training refers to technical training and other formal education. These factors are important because they influence the number of potential training requirements that are analyzed and trained. Use sources such as Course/Specialty Training Standards, Occupational Surveys, personal experience, etc., to build on this information.
Document assumption	Sometimes it's necessary to make assumptions about the target population. If this has to be done, base assumptions on the most current information from applicable sources.
Target population definition summary	A summation of this analysis is called a Target Population Definition. This definition becomes the baseline for the remaining analysis.

STEP 3
DETERMINE TASK-BASED TRAINING REQUIREMENTS

Introduction

In this step, an analyst decides what is and what isn't included in the training. This decision is made by comparing training requirements (Step 1) with the characteristics of the target population (Step 2).

Substep 1 **Identify Activities**

Purpose

The purpose of this substep is to document the sequence of activities used to complete each task; each activity is then analyzed to see if it can be classified as a potential training requirement.

Definition

An activity can be considered a discrete step toward the completion of a given task. Use any and all available data such as Technical Orders (TOs), personal experience, interviews with test personnel, etc., to build a list of activity statements. Each activity must, as a minimum, describe (1) the action taken, (2) the object of the action, (3) the equipment/tools used to perform the action, (4) precautions and likely errors, (5) any alternative activities, and (6) any existing contingencies.

Activities analysis

Each activity of every task is analyzed by answering five questions. Only those activities identified as potential training requirements need to be analyzed for related skill and knowledge behaviors. To analyze activities, answer the following:

Is the activity new? That is, has this exact step in this system, subsystem, or piece of equipment not been performed by the target population before?

Are there any abnormal conditions associated with performing the activity? Are there environmental limitations under which the activity must be performed, such as extreme noise or

Continued on next page

Activities analysis (Continued)	limited access? Is the equipment or material being handled hazardous, heavy, or bulky? Is more than one person required to manipulate switches? Are there new or unusual criteria related to the activity? Does the activity require new or stricter standards of performance for speed, timing, accuracy, or sequence? Is there a chance for negative transfer to occur? If the target population performs this activity in a manner previously learned, will it cause incorrect or dangerous results? Are any new or modified support tools or equipment required?
If no	If the answer to **all** of these questions is "NO," the activity is simply integrated into the training scenario for the benefit of cohesion. That is, it doesn't drive a training requirement but it's still needed to complete the task.
If yes	If the answer to **any** of these questions is "YES," the activity is considered to be a potential training requirement.
Substep 2	**Identify Skill and Knowledge Behaviors**
Introduction	Skill and knowledge behaviors form the foundation of the training. They influence the characteristics and type of training equipment as well as the structure of the instructional content.
Definition	A skill behavior is any discrete physical action that requires practice to master. Some examples are lifting or moving equipment, positioning components, and tightening or loosening hardware. A knowledge behavior is a fact, rule, or principle; it's a piece of information retained and results in observable behavior during the performance of a task.
Identification	Each of these types of behavior needs to be identified before applying any analysis parameters. Use the following taxonomy to help identify activities. These points clarify skill and knowledge behaviors related to an activity.

Continued on next page

Identification (Continued)

Skill and Knowledge Taxonomy	
ASO	ASSOCIATING; naming; responding to a specific input. The student associates the response with a specific input only. The response may be verbal or written. EXAMPLE: Naming objects or events; identifying parts of equipment, such as an AC power cord. ACTION VERBS (to join or combine things or thoughts; to link or correlate): IDENTIFY; RELATE; NAME; MATE; MATCH; INDICATE; LABEL; LOCATE.
RFP	RECALLING FACTS AND PRINCIPLES; remembering and maintaining knowledge or nomenclature, functions and physical lows. Restating basic knowledge through mental rehearsal or verbal/written recall. EXAMPLE: Recalling specific radio frequencies; listing equipment parts; stating Ohm's Law. ACTION VERBS (to bring back to mind or summon from memory): ENUMERATE; (RE)STATE; RECITE; REITERATE; ITEMIZE, QUOTE, REPEAT.
RPR	RECALLING PROCEDURES, sequences, or required behaviors in a specified order. EXAMPLE: Recalling checkout procedures or assembly/disassembly routines. ACTION VERBS (Same as RFP).
DIS	DISCRIMINATING; being able to distinguish between inputs. Making different responses to the different items within a class. EXAMPLE: Telling the difference between similar gauges on an instrument panel; noticing frayed wiring. ACTION VERBS (to mark the peculiar features of; to recognize as being different from others): DETECT; COMPARE; DISTINGUISH; DIFFERENTIATE; SELECT.

Continued on next page

Identification (Continued)

Skill and Knowledge Taxonomy	
CLS	CLASSIFYING; recognizing patterns; seeing the similarity among a class of objects or events which call for a common response; generalization. EXAMPLE: Aircraft classification (friendly, enemy, tactical, etc.). ACTION VERBS (to arrange in groups according to common characteristics; to assign systematically; to show sameness or unity of): GROUP; SORT; CATEGORIZE; RANK; RATE; ASSIGN; FILE.
RUS	RULE USING; applying a rule to a given situation by responding to a class input with a set of actions. Relating to two or more simpler concepts in the manner of a rule. A rule states the relationships among concepts. It's helpful to think of principles as "if/then" statements. EXAMPLE: If the signal indicator flashes, then lower the pressure in the pump. ACTION VERBS (to put into practice): CONVERT; CALCULATE; PREDICT; PRESCRIBE; TRANSLATE; TRANSCRIBE; VALIDATE; VERIFY.
PBS	PROBLEM SOLVING; making a decision based on limited information. Solving a novel problem by combining previously learned rules or generating new rules through trial and error. EXAMPLE: Isolating the source of a malfunction. ACTION VERBS (to find an answer or remedy for): STUDY; ANALYZE; ADAPT; CREATE; DEVELOP; DEVISE.

Continued on next page

Identification (Continued)

Skill and Knowledge Taxonomy	
PSM	POSITIONING & SERIAL MOVEMENT; positioning switches, buttons, knobs, levers, etc., either individually or in a chain of highly coordinated motor tasks. Motor aspects of equipment set-up and operating procedures. EXAMPLE: Following equipment turn-on procedures; typing; switch throwing. ACTION VERBS (to fix in place; to be set in relation to others): ALIGN; INSERT; TURN ON/OFF; (DE)ACTIVATE; TUNE; (DIS)ENGAGE.
CMV	CONTINUOUS MOVEMENT; perceptual motor skills involving continuous pursuit of a target or keeping dials at a certain reading. Compensatory movements based on feedback from displays. May involve scanning of complex displays to determine current status of the system and to predict the evolving state of the system. EXAMPLE: Steering on a constant course; tracking. ACTION VERBS (to follow closely on a regular course): TRACE; STEER; SLIDE; GUIDE.
RMV	REPETITIVE MOVEMENT/MANIPULATION or standardized behaviors/mechanical skills. Emphasizes dexterity, occasionally strength and endurance; requires lower level of a larger task. EXAMPLE: Use of hand tools such as a hammer, wrench, or power tools. ACTION VERBS (to bring together into a whole): SPLICE; TIGHTEN; LOOSEN; HOLD; CUT; DISASSEMBLE; LUBRICATE; GRASP; MEASURE; (DIS) CONNECT; DRILL.

Analysis cautions

Be very careful when analyzing behaviors. For example, being able to locate an object isn't the same as being able to name an object. That is, it isn't necessary to associate a name to an object in order to find it. The difference, although small, influences the type of learning (taxonomy) and therefore the type of training that's developed.

Examples

The example of "APPLY AIRCRAFT POWER" contains several behaviors. A technician would first need to find the power cable before connecting it to the aircraft. Therefore, the first behavior is knowledge-based and might be written as "IDENTIFY POWER CABLE." Phrase knowledge behaviors carefully; list any information that might help, form an objective such as performance conditions or criteria.

How to identify potential requirements

Now that skill and knowledge behaviors are identified, begin the analysis that determines which are potential training requirements. Each skill/knowledge behavior of every activity (identified as a potential training requirement) is analyzed by answering several questions. Only those skill and knowledge behaviors identified as potential training requirements need to be analyzed for equipment requirements.

Is the skill/knowledge new to the target population?
Is there an unusual condition attached to the skill/knowledge? For example, is there an awkward body movement necessary in performance, limited or "blind" access/visibility, etc.?
Are there new or unusual criteria related to the activity? Does the activity require new or stricter standards of performance for speed, timing, accuracy, or sequence?
Is there a chance for negative transfer to occur? If the target population performs this activity in a manner previously learned, will it cause incorrect or dangerous results?
Are any new or modified support tools or equipment required?

If No

If the answer to **all** of these questions is "NO," the skill or knowledge behavior is integrated into the training scenario for the benefit of cohesion. It doesn't drive a training requirement but it's still needed to complete the activity.

If Yes	If the answer to **any** of these questions is "YES," the skill or knowledge behavior is considered to be a potential training requirement.

STEP 4
DETERMINE CONCEPT-BASED TRAINING REQUIREMENTS

Introduction

In this step, skill and knowledge behaviors identified as potential training requirements are analyzed further for potential concept training requirements. That is, some of those pieces of knowledge that indirectly support potential training requirements (behaviors) may not be known to the target population.

Example

A jet engine mechanic has to perform engine changes from time to time. Part of being able to do this is knowing (cognitive domain) where the mount bolts are located and how to remove them. Note: These are the types of behaviors identified and analyzed in Step 3. But, there's another knowledge component here; mount bolts are required to be "close tolerance." They fit tighter and, therefore, create a more reliable structure. Does a jet engine mechanic have to know this to change an engine? It depends on the definition of the target population. This is "nice to know" information for someone who does nothing more than engine changes, but consider the same information within a different scenario. A jet engine mechanic is assigned to troubleshoot an engine vibration problem. The problem isn't severe enough to warrant an engine change, but it's noticeable. The vibration of the engine is induced into the airframe; why? "Close tolerance" mount bolts form a single structure of the engine and the airframe. Vibrations propagate through a solid mass more readily than through a looser structure. The word "troubleshoot" adds a new dimension to the task.

Cognitive training

The analysis performed in this step also supports potential training requirements that fall exclusively into the cognitive realm; for example, training scenarios that present a degree of understanding for system theory or management practices. These types of scenarios are on the same level with performance (psychomotor)-based tasks and are assembled or disassembled in the same way; they are referred to here as cognitive-based training requirements.

What is a concept?

In both contexts, a concept is an idea or group of ideas with common elements. From this perspective, a concept can be thought of as a set of common elements, each element having its own characteristics.

Substep 1 **Identify Concepts**

Purpose

The purpose of this substep is to identify concepts that are relevant not only to those behaviors identified as potential training requirements, but also to those tasks that fall exclusively into the cognitive realm (potential cognitive-based training requirements).

How to identify concepts

First, identify concepts that are relevant to potential behavioral training requirements. Next, identify those tasks (potential cognitive-based training requirements) that are exclusively within the cognitive realm. Apply the following six questions to each potential cognitive-based training requirement. If the answer to any of these questions is "YES," then it's considered a potential concept-training requirement and is analyzed in the remaining subsets.

Does the target population need to know about functional operations of components?
Does the target population need to know about associated system inputs (input signals or data from another system)?
Does the target population need to know uses, capabilities, and limitations of test equipment?
Does the target population need to understand and be able to apply knowledge of signal flow to find discrete components?
Does the target population need to use other data with test equipment to find faulty components?
Does the target population need to know and apply specific rules such as Ohm's Law?

Substep 2 **Identify Concept Elements**

Definition	Concepts are made of elements, much the same way that tasks are made of activities. Disassembling each concept into discrete knowledge parts (elements) identifies these elements.
Example	The concept of troubleshooting contains many elements. Three of these elements are: (1) identify the problem, (2) localize the problem to a subassembly or function, and (3) isolate the problem to the discrete component. The requirement to perform troubleshooting may have been identified in Step 3, but the concept or theory (collective concept elements) is identified here.
How to identify concept elements	Analyze each element and apply the following questions. Is the element relevant to the target population? An element is relevant when it has a direct bearing on the subject matter, so closely related to the concept as to provide reinforcement, or is required for understanding and reinforcement. Is the element incidental to the target population? These elements are similar to those activities and behaviors that weren't identified as potential training requirements but were included for the sake of cohesion.
If no	If the answer to **both** of these questions is "NO," the element is discarded.
If yes	If the answer to the **first** question is "YES," the element is identified as a potential concept element-training requirement. These are the only elements considered for further analysis. If the answer to the second question is "YES," it isn't considered for further analysis, but is included in the training scenario for the benefit of cohesion.
Substep 3	**Identify Characteristics of Elements**

Introduction

Characteristics make an element unique. Referring to the previous example, the concept of troubleshooting, each element implies progress toward a goal. It's because of the unique characteristics of each element that a technician can reach that goal.

Example

To identify a problem in an avionics system, technicians must use several of the physical senses (that's one characteristic) and be able to understand the sequential signal flow from one component to another (that's another characteristic). Technicians must also understand the functional operation of each component (characteristic) as well as each component's interrelationship with others (yet another characteristic).

How to identify characteristics

Remember, characteristics are identified only for potential concept element training requirements that are "RELEVANT."

Ask these questions:

Is the characteristic new? Has this target population been exposed to this level of understanding on this system?
Is the characteristic complex? That is, is it detailed, does it require a higher level of scientific theory, or understanding of mathematical formulas?
Is the characteristic critical? Can the element be understood without it?

If no

If the answer to **all** of these questions is "NO," the characteristic can be discarded.

If yes

If the answer to **any** of these questions is "YES," it's identified as a potential element characteristic training requirement and documented.

STEP 5
DETERMINE MEDIA AND METHODOLOGY

Introduction

If there's a training requirement, something must be used to teach it some form of media. The first image that comes to mind is an instructor standing in front of a class lecturing from transparencies. This is the most common way to get a point across, but not always the most effective. Instructional scenarios should stimulate the senses.

In this step, the analyst is prompted by a series of questions. Answers given in response to these questions determine the best delivery method, domain of learning, whether hardware or alternate media is used, the appropriate media class, and the best method of instruction for each media class.

Substep 1 **Determine Method of Delivery**

Purpose

The purpose of this substep is to determine how the instructional message is delivered.

How to deliver instruction

There are two ways to deliver the instructional message, (1) by an instructor or instructor-based delivery, and (2) by specific media or media-based delivery.

Instructor-based delivery

Instructor-based delivery may use a variety of media such as transparencies, exhibits, etc., but without the instructor the media is lifeless. That is, the media can't deliver the instructional message by itself; media only supports delivery of the instructional message.

Media-based delivery

In media-based delivery, an instructor isn't necessary for learning to take place. The media is a self-contained instructional unit; it provides (in most cases) stimulus and feedback, and an instructor supports delivery of the instructional message.

How to determine method of delivery

To determine the method of delivery for behaviors and concepts, ask the following questions:

Is the instructional content dynamic? If the content is likely to change, requiring updates more than once a year, it's considered to be dynamic. The cost of updating media-based materials is very high compared to updating alternate media.

Does the behavior deal with interpersonal skills, behavior modification, or change in attitude? This focuses on the affective domain of learning. Human interaction is generally more effective in a classroom or laboratory environment.

Is team effort or interaction with an instructor important? Where team efforts are concerned, it's usually desirable to let an instructor control the learning environment.

Does the behavior require feedback on performance of motor skills or procedures? When students work to master a psychomotor skill they require feedback to correct undesirable behavior.

Is the instructional message intended for wide distribution? Consider the target population and where they'll be located. If the target population is scattered throughout a geographical location, then the instructional message needs to be exported. The cost of sending instructors may be prohibitive; therefore, hardware (media-based instruction) may be appropriate.

Is it critical that the content be delivered the same way every time? While it's certainly desirable, it's seldom critical. This is intended to identify those behaviors where inconsistent or faulty instruction could lead to unsafe acts on the part of the target population.

Should the instructional content be adaptable to individual differences and/or allow individuals to control the pace or amount of practice? In situations where extremes exist in individual capabilities, learning styles, or previous training/ experience, media-based material may be appropriate.

Is face-to-face instruction impractical? Consider the availability of qualified instructors, instructor-to-student ratios, and temporary duty (TDY) costs. If any of these factors apply, media-based material is appropriate.

Continued on next page

How to determine method of delivery (Continued)

Note: Each skill/knowledge behavior and concept training requirement is analyzed using these same eight questions. Notice, also, that the first four questions are considerations for instructor-based delivery and the last four questions are considerations for media-based delivery. Use Yes/No answers to these questions to determine your media recommendations

Substep 2 **Determine Domain of Learning**

Introduction

The domain of learning is another key factor that helps determine whether to use hardware or alternate media. In this substep, the domain of learning is determined for both delivery methods, instructor-based and media-based.

How to determine domain of learning

To determine the domain of learning for instructor- or media-based delivery, each behavior and concept is analyzed using these questions. If the answer to any one question is "YES," an analyst is directed to the appropriate domain of learning. Document the results.

Is the behavior a motor skill? If so, it is a psychomotor domain of learning. A motor skill is a matter of dexterity, that is, a given body movement or motion that's practiced so much that it becomes automatic. For example, tightening a bolt with an adjustable wrench is a motor skill that some 3-skill-level technicians must practice. Practice is required for them to learn how to use the wrench with one hand and adjust it without dropping it.

Does the behavior call for knowledge or mental skills? If so, it is a cognitive domain of learning. Task knowledge are facts and principles that support performance. Mental skills allow a person to make decisions, discriminate between similar inputs, or to recognize the difference between objects/concepts.

Continued on next page

How to determine domain of learning (Continued)

Does the behavior require a change in attitude? If so, it is an affective domain of learning. Attitudes refer to an internal state that influences the choices a person makes. This consists of emotional and intellectual aspects. The point of focus here is those attitudes that can be changed with exposure to role models, opportunities for successful accomplishment, and positive reinforcement.

Conclusions

To this point, the delivery method and domain of learning are known for each behavior and concept. The 374 TDS recommends analyzing training requirements identified for instructor-based delivery first.

Substep 3

Determine Instructor-Based Delivery Requirements

Are motor skills required?

If motor skills (psychomotor domain) are required in learning, analyze the behavior or concept by answering the following questions:

Is the behavior difficult to execute? If the behavior is difficult to execute, it's probably difficult to master without some hands-on practice. For example, adjusting the color bias on a television or adjusting a carburetor on a running engine.

Are there unusual conditions? Consider the working environment and stressful situations such as working in cramped quarters or where pacing of events can't be controlled.

Are there special performance criteria? Criteria are standards of performance. Are there specifications that can't be met without practice?

Are there hardware cues that affect performance? The actual equipment may provide feedback that's too difficult or complex to explain. Simulation of equipment feedback may be shown with audiovisual media or hardware. Which is most cost-effective?

Are new support tools/equipment required? Note: "Tools" are not only wrenches and hammers but also mathematical equations, computer programs, formulas, etc. However, the concern here is hardware-type tools. Other tools should be analyzed as alternate media.

Continued on next page

Are motor skills required? (Continued)	Are the consequences of error high? This focuses on chances of personal injury or damage to equipment if the behavior isn't performed correctly. An aircraft egress system, for example, isn't taught on actual equipment for 3-skill-level training; one mistake is enough to kill a person and damage equipment. Is the frequency of performance very high or very low? Some behaviors are performed so often that practice on a hardware training device leads to greater efficiency. On the other hand, behaviors (such as emergency procedures) may be performed so rarely that they're forgotten unless practiced often.
If yes	If the answer to **any** of these questions is "YES," the analyst is directed to use a hardware (HW) training device.
If no	For "NO" responses, hardware isn't used, so alternate media is the appropriate choice. Consider the relevant factors used as stimuli. These factors influence student performance.
Alternate media	Media includes, but is not limited to: Print Audio Projected still visual Audio projected still visual Motion visual Audio motion visual Color motion visual Color audio motion visual
How to determine alternate media	To determine the appropriate alternate media for a behavior or concept (psychomotor domain), answer the following questions: Is display of motion necessary? In some cases, students may have to respond to feedback from system components; the reverse may also be true.

Continued on next page

How to determine alternate media (Continued)

Is color necessary? Unless color flags an important aspect of system operation (warning lights, for example) or is present in a real scenario, it isn't necessary.
Is sound necessary? Again, consider whether or not this factor flags an important aspect of system operation or is present in the real scenario.

Note: All other behaviors and concepts are understood to require hardware. These are analyzed at a later time.

Are knowledge skills required?

If knowledge skills are required, you must analyze the behavior or concept. Ask the following questions:

Does the behavior involve unfamiliar concepts or objects? Consider whether or not the target population was ever exposed to this specific behavior. This includes equipment as well as environment.
Does the behavior involve interpersonal skills? Consider any interaction/communication between people.
Is display of motion necessary? Again, students may have to respond to feedback from system components.
Is sound necessary? If it flags important aspects of system operation or is present in a real scenario, the answer is "YES."
Is it practical to demonstrate the real thing in class? For example, it isn't practical to bring a complete jet engine into class to teach the knowledge portion of removing mount bolts. Remember that this is the cognitive domain.

By answering these five questions, the analyst is led to the appropriate alternate media.

Substep 4 **Determine Media-Based Delivery Requirements**

Synopsis

An analyst may have determined earlier that a given behavior is suited to media-based delivery. That is, the training scenario is controlled by some type of media that provides stimuli, monitors student response, and provides feedback. Now you need to determine delivery requirements for all three domains of learning supported by media-based delivery.

Substep 5 **Determine Method of Instruction**

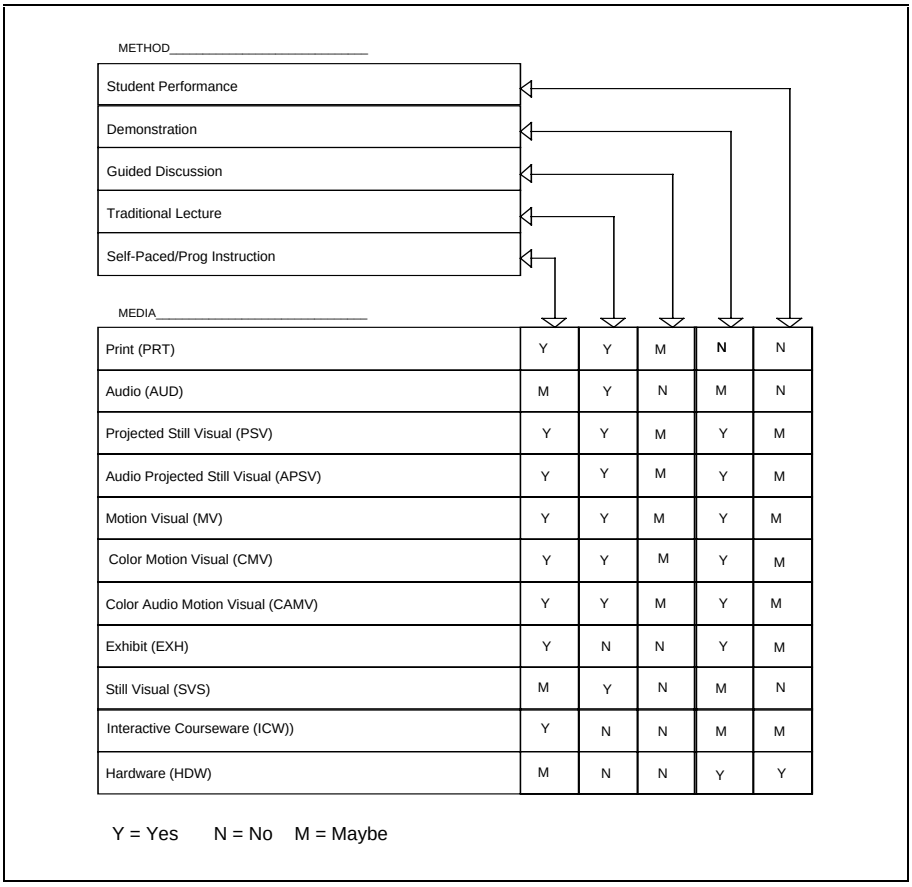
Introduction

The purpose of this substep is to determine the best method of instruction for each media class (within alternate media) identified earlier.

How to determine method of instruction

The best way to determine method of instruction is to use a matrix of media/method (see Figure E-1). To use this matrix, match the method of instruction with the best media for the training.

Figure E-1 Media/Method Matrix



STEP 6
DEVELOP INSTRUCTIONAL STRATEGIES

Introduction	This step is designed to refocus efforts at the task level. The end product is a preliminary overview of the training scenario.
Substep 1	**Develop Criterion Objectives**
Definition	When phrased properly, criterion objectives specify under what circumstances a behavior is performed (condition), exactly what must be done (behavior), and how well the behavior is performed (standard).
Description	The condition describes the important aspects of the performance environment. Examples of these aspects are the tools the students are given to work with, access to technical data, and special instructions. The behavior of a criterion objective is observable and measurable. That is, students must demonstrate a knowledge or performance so that an instructor can determine/see a specified degree of skill or change. The behavior also matches, as closely as possible, actual task performance. The standard of a criterion objective specifies the precise degree of completeness and accuracy of a behavior. The degree of completeness and accuracy may be stated as compliance with Tos, minimum levels of acceptable performance, time requirements, rate of production, etc.
Potential training	Criterion objectives are developed only from those tasks and concepts identified as potential training requirements. Consider each one carefully; some may not be observable or measurable.
Instructional goals	Training requirements that are neither observable nor measurable are integrated into the training scenario, but are written as instructional goals. Instructional goals have a similar written format to behavioral statements.

Substep 2 **Develop Tests**

Introduction

As stated earlier, criterion objectives must be observable and measurable. Therefore, all criterion objectives must be measured with either a written or performance test. Of primary concern for written tests is clear communication of questions or problems to students.

Guidelines for test development

Following are some guidelines for developing tests.

Write tests to the reading grade level of the target population.
Don't write tests with the intent of tricking students.
Use correct grammar.
Use plausible distracters.
Use some type of illustration to clarify complex scenarios.
Don't give away the correct answer to a question in its stem or in a previous question.
Give clear instructions to the examiner and students.
Compare the test material to the criterion objective to ensure that it measures the intended behavior and standard.

Performance test guidelines

Performance tests need to be structured correctly if students are to retain the instructional message. Pushing students into the actual performance test before they're ready causes frustration, confusion, and lack of motivation to concentrate on the remainder of the instruction. The following are some guidelines to follow for developing performance tests.

Performance tests need to be demonstrated. This not only clarifies aspects of the procedure, but serves as a summary for the whole task.
Give students enough practice before actual testing. If time permits, let them practice until they feel confident with the scenario. Allow them to practice at least twice for complex scenarios.
Identify appropriate safety precautions and procedures.
Include any special instructions to the examiner in the Instructional Guidance. Special instructions might point out considerations for preparation, timing of certain events, or alternate plans.

Substep 3	**Develop Media Descriptions**
Purpose	The purpose of this substep is to determine specific types of media for each alternate media class from Step 5, then write a brief narrative describing specific types.
How to develop media descriptions	To develop media descriptions, answer the following questions. Are materials readily available? For example, if print media is needed, are there existing manuals and illustrations to support the need? What are the production costs for different media within a given class? How much time is available for development? How many times will the training be offered? If it's offered one time, don't spend the money for elaborate media. Is the media subject to frequent change? This can also be costly for certain types of media.
Identify resource requirements	At this point, identify any resource requirements. Doing this now allows plenty of time for changes, revisions, etc. Resource requirements include any type of hardware support for specific media such as projectors, cameras, dry marker boards, etc.
Substep 4	**Develop Written Overview**
Purpose	The purpose of this substep is to define how specific alternate media and resources are used in the training scenario or how they're used to help deliver the instructional message.
Documentation	As you write your overview, estimate and document the number of hours needed for each training requirement. Base this estimate on task performance data and personal experience.
Substep 5	**Sequence Training Requirements**

Purpose

The purpose of this substep is to structure the training scenario. Structuring allows students to comprehend relationships that exist between concepts, skill and knowledge behaviors, activities, and tasks.

Definition

There are two levels of structuring: (1) macro structuring, and (2) micro structuring.

Macro structuring consists of the largest divisions by major subject matter or topic. Using this structuring allows the training scenario to be divided according to major work areas, systems, or levels of progression. Once this is complete, micro structuring can begin.

Micro structuring simply allows potential training requirements to be structured into major divisions. This involves sequencing activities into tasks and tasks into objectives. There are three ways to sequence these activities and tasks during micro structuring: (1) by job performance order, (2) by psychological order, and (3) by logical order. These are explained as follows.

Sequencing by job performance order produces an instructional environment that replicates the real environment. It's very effective in scenarios where students must produce immediately. This tends to have a high level of psychological impact that translates into quality job performance.

Sequencing by psychological order focuses on the concepts of known to unknown, simple to complex, and whole to part-whole. However, this type of sequencing is subjective; the analyst determines what's known and unknown, simple and complex, etc.

Sequencing by logical order is a combination of the first two types and leans heavily toward whole to part-whole.

Determine common elements

Determine whether or not any objectives (for concept-based training requirements) have common elements. These objectives are placed at the beginning of the training because they represent concepts that are fundamental to several tasks. For example, the concept of physical force is fundamental to learning how simple machines work. Therefore, instruction on this concept precedes instruction on specific machinery.

Prerequisites

Next, determine if there are any skill and knowledge behaviors that are prerequisites for others. It may be beneficial to place these into objectives and sequence them before others. Also, while making this determination, look for chains of events that must be performed in specified order.

STEP 7
IDENTIFY HARDWARE FIDELITY REQUIREMENTS

Introduction

By this time, an analyst has formed a general idea of what the hardware requirements are for media classes identified in Step 5. However, the degree of hardware fidelity needs to be determined. That is, how realistic must the hardware be to support the training scenario? Also, this analysis helps determine the degree of fidelity needed to teach individual skill behaviors; this is possible because tasks are analyzed to the skill and knowledge behavior level (Steps 1 through 4). This prevents development of hardware training devices that perform more functions than are absolutely necessary to deliver the instructional message.

Substep 1 **Identify Hardware Fidelity Requirements**

Introduction

There are two aspects to fidelity requirements for any hardware training device: (1) functional, and (2) physical. Each of these aspects is analyzed for the quality or degree of stimulus, response, or feedback.

Purpose

The purpose of this substep is to identify and analyze hardware for functional and physical fidelity requirements.

How to identify hardware functional fidelity requirements

Examine the media classes for both instructor-based and media-based delivery. Specific hardware for these media classes is identified by considering which major assemblies, subassemblies, or lower assembly units students come in contact with (for a given training requirement). Answer the following questions.

Does the hardware have a functional impact? The functional impact of hardware consists of both stimuli and feedback. Therefore, it's considered from both perspectives. If students must receive information from hardware to perform a task or make a decision, the answer to this question is "YES."
Is the stimulus/feedback difficult to understand? For example, a digital pressure gauge is easier to comprehend than an analog pressure gauge; analog scales are continuous with an infinite number of values from point A to point B and, therefore, it's more difficult to determine an exact value.
Is the stimulus/feedback difficult to understand because of motion, body position, or feel? This considers whether or not the hardware is in motion during task performance, awkward body positions interfere with performance, and/or discrimination between some physical characteristics of the hardware makes it difficult to make a decision.
Is there something unusual, abnormal, or dangerous about the hardware? Use personal experience and good judgment to answer this question. Careful consideration should be given to scenarios with moving parts, explosives, and new or modified tools.

Note: Depending on a given response, an analyst may be directed to label the hardware as having various levels of fidelity.

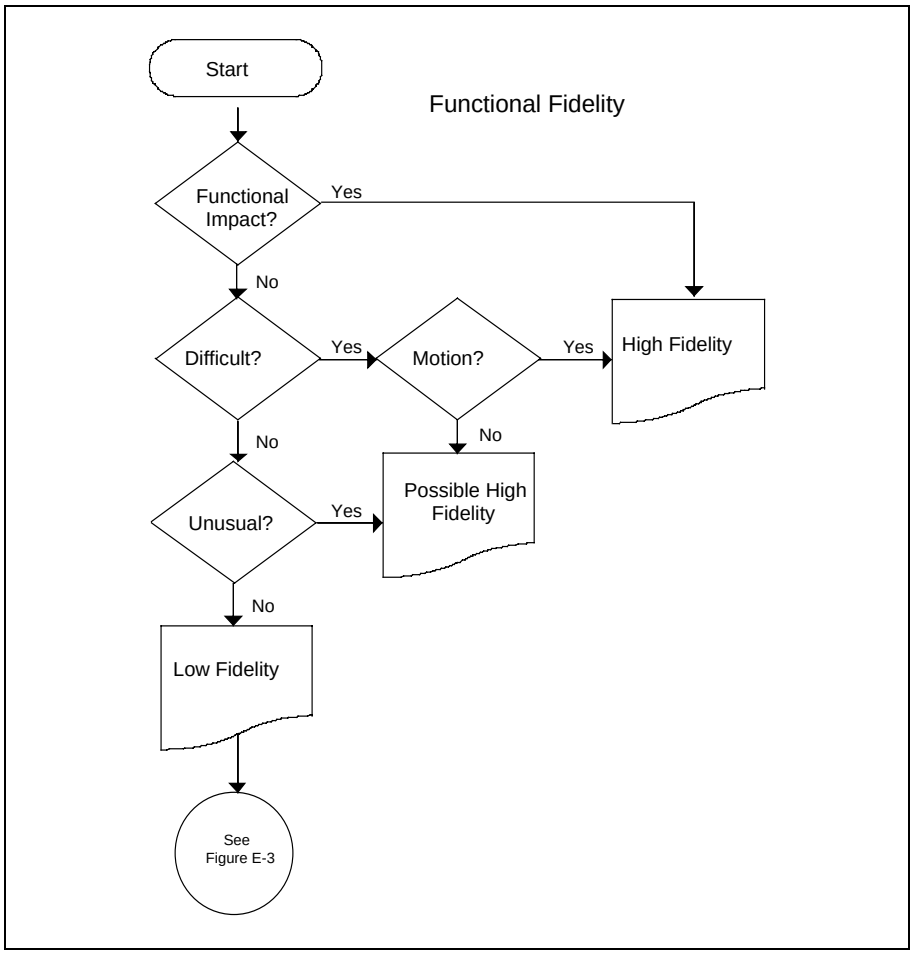
Example

A behavior requires the target population to use a new piece of test equipment. The test equipment is new only because a modification included an external manual adjustment. Since the test equipment has a functional impact, it requires "High" (H) functional fidelity; specifically, the external manual adjustment.

Functional fidelity

Use the flowchart in Figure E-2 to determine the degree to which each piece of hardware must act like the real thing.

Figure E-2 Functional Fidelity



How to determine physical fidelity requirements

No matter what the response is during functional fidelity analysis, an analyst must determine the degree to which the hardware must look like the real thing. Ask the following questions.

Is the hardware acted upon directly? If students must come in physical contact with the hardware, the answer to this question is “YES.”

Continued on next page

How to determine physical fidelity requirements (Continued)

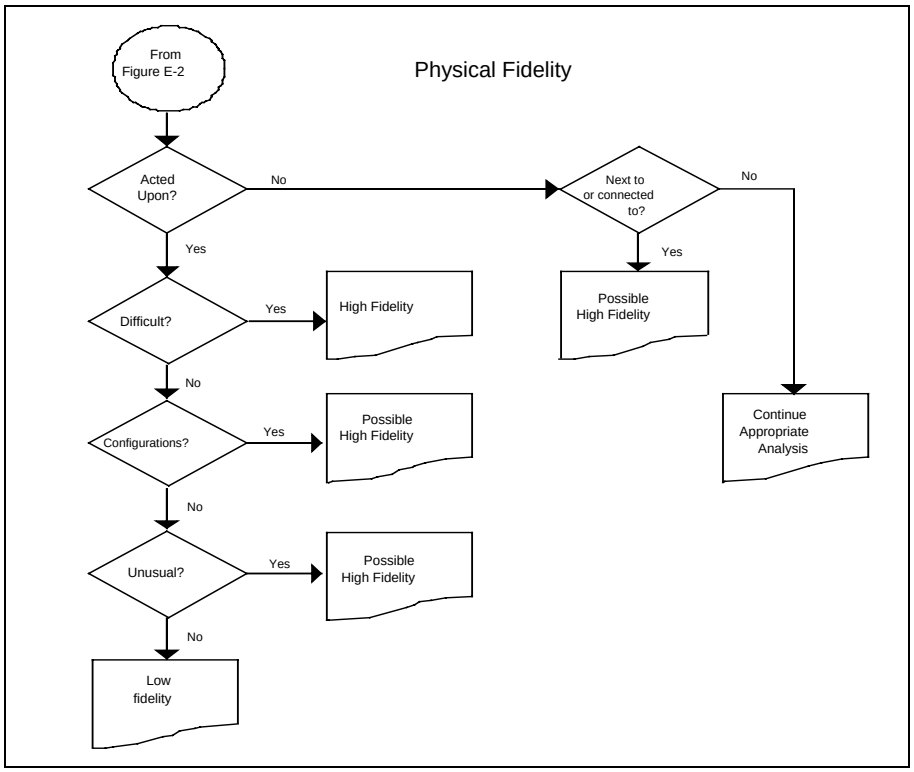
Is the hardware next to or connected to high (H) fidelity hardware and does it enhance students' understanding? In some cases, hardware may not provide stimuli, response, or feedback; it's merely next to or connected to hardware that does.
Is unaided judgment used to respond to hardware outputs (difficult response)?
Are there many possible hardware configurations? It's simply easier for students to comprehend the overall scenario using a single high (H) fidelity piece of hardware as opposed to numerous low (L) fidelity components.
Is there something unusual, abnormal, or dangerous about the hardware?

Again, depending on the response, an analyst may be directed to label hardware as "High" (H) fidelity, "Possible High" (PH) fidelity, "Low" (L) fidelity, or "Possible Low" (PL) fidelity.

Physical fidelity

Use the flowchart in Figure E-3 to determine the degree to which the hardware must look like the real thing.

Figure E-3 Physical Fidelity



Substep 2 **Perform Whole-Hardware Analysis**

Purpose

This analysis is intended to make the hardware training device appear as realistic as possible at minimal expense. Most hardware training devices include components such as dials, switches, lights, etc., from the actual equipment. But, depending on the training scenario, many of the components may be nonfunctional.

Example

Consider, for example, what should be done with the fifth indicator in a group of five, if students receive stimuli/response/feedback only from the first four. It's suggested that the fifth indicator be included as a "Low" (L) fidelity component.

Why include various components?	There are two reasons to include these types of components. First, it makes the hardware training device look realistic; second, including a modest number shouldn't add significant material costs. Two-dimensional drawings or photographs can represent many of these low fidelity components.
Consider operational hardware	In some cases it may be more expensive to fabricate the hardware training device with low fidelity components than to use the actual hardware. Will including low fidelity components contribute to learning? Or would it be best and most effective to use actual hardware?
Substep 3	**Compile Fidelity Recommendations Within Tasks**
Introduction	Keep in mind that the hardware requirements analyzed in the previous steps/substeps are developed from potential behavioral training requirements. In turn, these behavioral training requirements are developed from a given activity within a given task.
Purpose	The purpose of this substep is to compile fidelity decisions within that given task. The hardware requirements for a given activity are probably used in other activities of the same task. Therefore, these same hardware requirements are probably labeled with varying fidelity levels. These fidelity labels, for common hardware requirements, must be compiled first.
How to compile	To compile fidelity recommendations within tasks, look at the hardware requirement for the first potential behavioral training requirement of the first activity within the first task. Now, search the rest of the activities in the first task for the same hardware requirement. For this same hardware requirement, total the number of "High" (H) fidelity labels; do the same for the "Possible High" (PH) fidelity labels, "Low" (L) fidelity labels, and "Possible Low" (L) fidelity labels.
Substep 4	**Compile Fidelity Recommendations Within Blocks**

Purpose

Just as some hardware is common to more than one activity within a task, some hardware may be common to more than one task within a block. The purpose of this substep is to compile fidelity decisions within blocks.

How to compile

Search the hardware requirements analyzed in Substep 3, within each task, to identify common hardware requirements within blocks of instruction. The end result should be a hardware training device that can be used in more than one unit and/or objective.

Substep 5

Compile Final Fidelity Recommendations

Synopsis

The procedures for this substep are identical to procedures in Substeps 3 and 4, only performed a step higher in the structure of the training scenario. The purpose of this substep is to compile fidelity decisions within the entire course of instruction. That is, there may be hardware requirements that are common to more than one block of instruction. This subset is simply a compilation of the previous substeps in Step 7.

STEP 8
IDENTIFY INTERACTIVE COURSEWARE (ICW) FIDELITY REQUIREMENTS

Introduction

Research shows that ICW is a very powerful media in terms of presenting information; it allows development of conceptual skills, analytical skills, and psychomotor skills. It can take many forms, including text-based and interactive video (IVD).

Purpose

The purpose of this step is to determine the type of ICW best suited to training requirements.

Substep 1

Identify ICW Fidelity Requirements

Background

Potential training requirements that need to be presented with a media class of ICW are already identified. This is done in Step 5. All potential skill-, knowledge-, and concept-based training requirements within this media class are analyzed here for fidelity requirements.

Why is ICW analysis different?

The analysis for ICW fidelity differs from that of hardware fidelity in the level of focus. In hardware fidelity analysis, the focus is on the actual hardware required to support a behavior or concept. Here, the focus is on course content.

Example

For example, a given task may require students to apply electrical power to an aircraft's avionics systems. An activity in this task requires them to turn on the battery switch. The skill behavior, here, is to physically move the toggle switch from "OFF" to "ON." A knowledge behavior is the understanding why the switch must be turned on; one concept used to help understand this behavior is that of electron flow. If it's already determined (from Step 5) that the media class for these behaviors is ICW, then the battery switch, associated system knowledge, and concept of electron flow are analyzed for fidelity requirements.

How to conduct ICW analysis

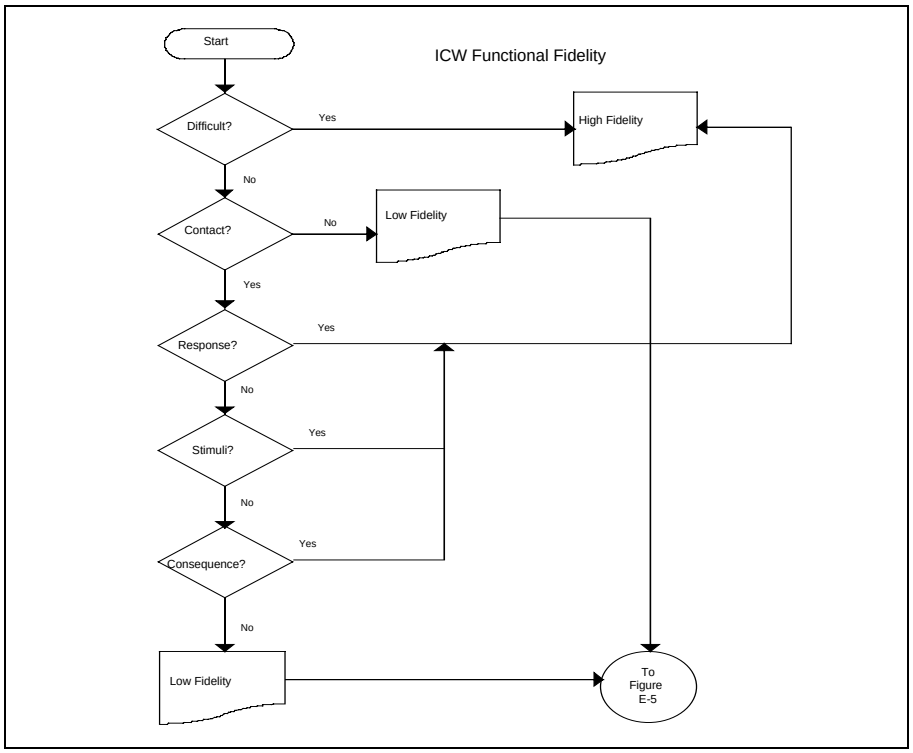
Conduct the analysis by answering the following questions.

Is the skill, knowledge, or concept difficult to understand? Consider whether or not it's difficult to understand without seeing an animated representation.
Do students come in contact with system components during actual maintenance? If students are manipulating controls or making judgments based on system performance/status, the answer to this question is "YES."
Is it difficult to make a response? Consider close coordination between team members and quick cognitive or psychomotor reaction.
Is the response based on specific system stimuli? Stimuli may be in the form of feedback.
Is there a high consequence for incorrect student performance? Consider what's going to happen if students perform the activity incorrectly or out of sequence.

ICW functional fidelity

Use the flowchart in Figure E-4 to determine ICW functional fidelity.

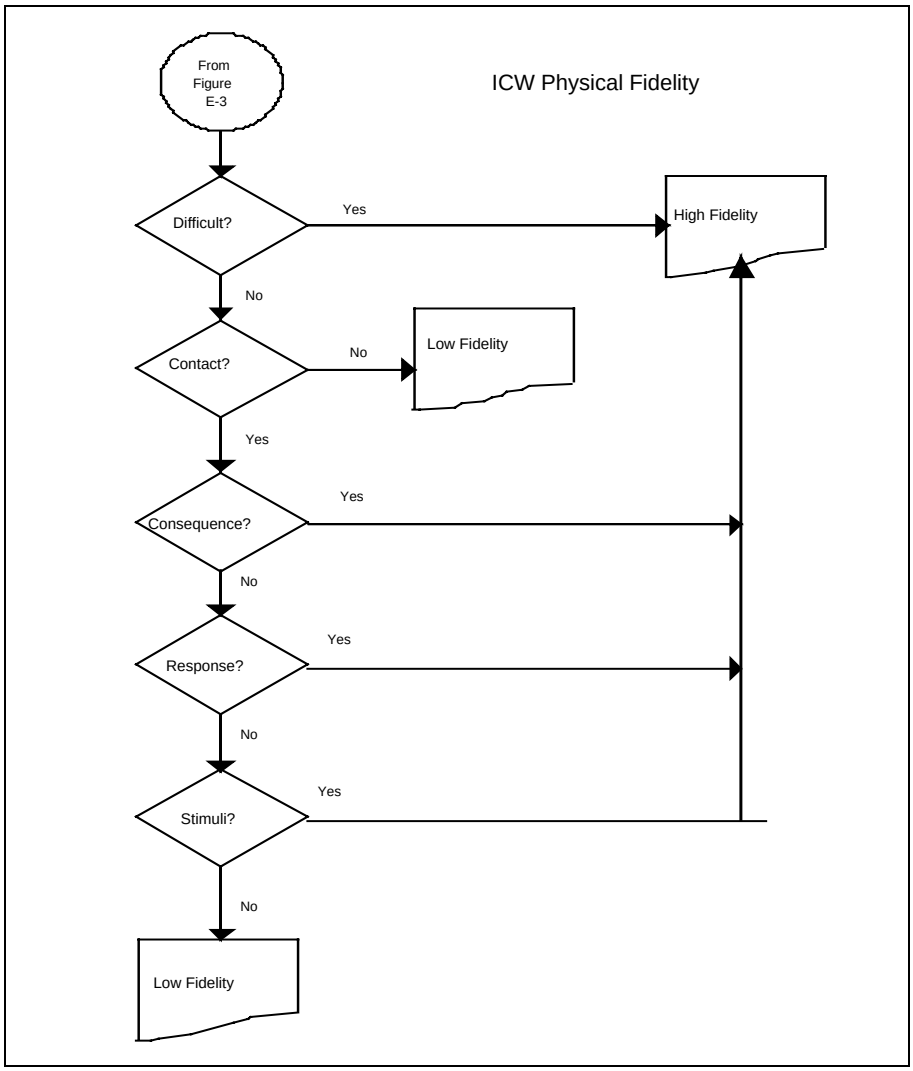
Figure E-4 ICW Functional Fidelity



ICW physical fidelity

Use the flowchart in Figure E-5 to determine ICW physical fidelity.

Figure E-5 ICW Physical Fidelity



Substep 2 **Compile Final ICW Fidelity Recommendations**

Purpose

The purpose of this substep is to compile all ICW fidelity analysis data into a cohesive package. These final recommendations are used to develop ICW.

Background

Notice that there's no middle ground for the fidelity labels in Substep 1. Each skill, knowledge, or concept either needs to be presented in detail or isn't critical to understanding.

Conclusions

Considering that both functional and physical fidelity requirements can have either of these two labels, there are only four possible scenarios that can exist for each type of training requirement. These scenarios are explained next.

A low functional and low physical scenario indicates that the training requirement can be met with a text-based tutorial; there are no visual cues or system functions that students must react to. Text-based tutorials may take the form of discussions on specific concepts, which are used later. They may also take the form of study aids that reinforce classroom instruction.

A high functional and low physical scenario indicates that the training requirement can be met with animated graphics with text support. Animated graphics illustrate abstract concepts while simulating some aspect of operation.

A low functional and high physical scenario indicates that the training requirement can be met with static graphics. Static graphics are generally used to clarify points.

A high functional and high physical scenario indicates that the training requirement can be met with two-dimensional part-task simulations. Creating a performance environment requires animation, and this type of ICW is designed to give the visual and auditory cues that go along with manipulation of controls. A two-dimensional part-task simulation can be developed using computer animation, interactive video, and variations/combinations of the two.

STEP 9
IDENTIFY INSTRUCTIONAL FEATURES

Introduction

There are four aspects to any training scenario: (1) stimuli, (2) response monitoring, (3) feedback, and (4) next task or activity.

Stimuli prompt students into action and come from one of two sources: (1) an instructor, or (2) hardware/alternate media. Cues from these sources give students information that leads them to proceed with a given performance.

What students do after seeing, hearing, or feeling stimuli is called the response. In response to stimuli, students perform a task or an activity. Student response must be monitored in one of two ways: (1) by an instructor, or (2) by hardware/alternate media. The data gathered during response monitoring is used to provide a degree of feedback to the students.

Feedback either reinforces student behavior or helps correct it, depending on the data received during response monitoring. Feedback may also prompt students to begin the next task or activity; once this happens, feedback is then considered stimuli.

The feedback/stimuli that directs students to perform the next task or activity comes from (1) an instructor, or (2) hardware/alternate media.

Commonality

Notice that there's one thing in common for all four aspects. Either an instructor or hardware/alternate media controls the training scenario. Skill, knowledge, and concept training requirements, to this point, are already determined as delivered by the instructor or media.

Purpose

Even though media-based delivery is directed for some behaviors and concepts, it may be necessary for an instructor to control one of the aspects of stimuli, response monitoring, feedback, or next activity. The purpose of this step is to identify instructional features for those skill/knowledge behaviors and concepts with a media class of HW, ICW, or EXH; specifically, which (instructor or media) controls one of the given aspects and what features are assigned to them. Each hardware training device (or supporting hardware), under these media classes, is analyzed in this step.

Substep 1 **Identify Stimuli Controls and Features**

How to identify

Look at the first behavior or concept with a hardware requirement and define the stimuli. Once this is known, answer the following questions to identify which (instructor or media) controls stimuli and whether features are preprogrammed or variable:

Does the hardware control the stimuli? If dealing with a simple task, such as remove and replace, instructors can effectively control the stimuli and keep the training scenario realistic.

Does the hardware control the intensity of stimuli? Intensity is defined as pitch, tone, volume, or duration for audio stimuli and brightness or duration for visual stimuli.

Is the intensity preprogrammed (PP) or variable (VAR)? Preprogrammed means that each student sees the exact, same presentation no matter when instruction is given. Variable means that the presentation is adapted to individual student needs. One or the other is included as a feature; it's simply a choice an analyst must make. This position is maintained in the remaining analysis of Step 8.

Does the hardware control the rate of stimuli? Consider whether or not the hardware training device must emulate system operation.

Is the rate preprogrammed (PP) or variable (VAR)? Refer to the clarification in the third question.

Continued on next page

How to identify (Continued)	Does the hardware control the signal-to-noise ratio? A signal is defined as the instructional message, whatever it may be. Noise is defined as anything that interferes with or blocks the signal; it distracts students' attention from the training scenario. If the training scenario is very active/interactive, the hardware is designed to control this feature. Is the signal-to-noise ratio preprogrammed (PP) or variable (VAR)? Refer to the clarification in the third question.
Substep 2	**Identify Response Monitoring Controls and Features**
How to identify	Consider the following: Is hardware freeze capability required? Freeze capability stops the training scenario temporarily, after a specified number of student errors, a fatal error, or when time limits are exceeded. Consider whether or not the nature of the training scenario prompts frequent mistakes. Are the freeze criteria preprogrammed (PP) or variable (VAR)? Do students remove the hardware freeze? If instructors are available to do this, let them. This ensures they're aware of individual needs and puts the human factor back into the training scenario. If students remove the freeze, remediation must be included; this remediation is designed to keep students from making the same mistake twice. Is remediation preprogrammed (PP) or variable (VAR)?
Substep 3	**Identify Feedback Controls and Features**
How to identify	Specific feedback must be identified before continuing. Use the following questions to identify controls and features for feedback: Is feedback provided by the hardware? Consider how much control is given to the hardware already and whether or not the hardware is used in a self-paced training scenario. Does the hardware provide the consequences of a false response? If the hardware is to simulate the actual equipment or provide remediation, the answer is "YES." Is the feedback preprogrammed (PP) or variable (VAR)?

Substep 4	**Identify Next Task/Activity Controls and Features**
How to identify	The next task/activity must be identified before continuing. Use the following questions to identify controls and features. Does the hardware control whether or not students proceed to the next activity? Consider the complexity of the training scenario. Is the next activity variable? Is the variability derived from student response or student score? Variability derived from student response acknowledges the many possible hardware configurations; this feature causes hardware to simulate actual equipment and students are free to treat it as such (freeplay). Variability derived from student score limits the possible action a student may take. This feature is best suited for tasks or activities that are critical in nature or to reinforce the instructional message to lower skill levels. *Note: The last six steps of the 15-step process are brief and summarized below.*

STEP 10
PREPARE TRAINING EQUIPMENT ANALYSIS SUMMARY AND FUNCTIONAL SPECIFICATION

Synopsis

This document is used to record training equipment design requirements. It's used by the Program Office (PO) to prepare the Request For Proposal (RFP). The format will vary depending on SPO requirements.

STEP 11
PREPARE COURSE CONTROL DOCUMENTS

Synopsis

A proposed Course Chart (CC) and Course Training Standard/Specialty Training Standard (CTS/STS) are now derived from the analysis. This is an AETC-specific requirement.

Purpose

The analysis from this ISD process provides the majority of the information needed for development of the CC and CTS/STS. Estimates of course lengths, instructional design, hardware training devices, and AETC-furnished equipment can be derived.

STEP 12
PREPARE INSTRUCTIONAL MATERIALS AND TESTS

Synopsis

Preparing instructional materials and tests requires preparation of criterion objectives (Steps 6 and 11). These criterion objectives are listed in the appropriate CCDs and form the basis for this step. Use the analysis data from Steps 3 and 4 when developing test items for criterion objectives. AETC-specific requirements and guidance are in ATCR 52-3 for testing policy/procedures for resident training, and ATCR 50-21 for FTD courses. Guidance and format requirements for training literature (used in resident training) can be found in ATCR 52-2 and ATCR 50-21 (for FTD courses).

STEP 13
VALIDATE INSTRUCTION

Synopsis

Validation begins as soon as proposed CCDs are printed in their final form. The initial step of the validation phase makes copies of CCDs available to MAJCOMs, FTDs, and/or the Prime Center responsible for weapon systems support (for their review and recommendations). Review and recommendations by these agencies includes providing instruction to a small group of specialists. Time constraints placed on this test bed determine the extent of the validation phase.

STEPS 14 AND 15
CONDUCT AND EVALUATE TRAINING

Synopsis

These steps represent the final proof of the ISD process. They're accomplished in a formal training environment at the operational site. At this point, conduct, management, and evaluation of the course are the responsibility of the using agency. If training analysis and development are performed properly, the result is a training program that instructors are familiar with, and hardware training devices that are justified.

Additional help

If you feel that you need additional information, you may write the 374 Training Development Squadron and request a copy of their procedures manual, which is available on IBM-compatible floppy disk. As mentioned earlier, they also have an ISD automation software package (ISDA). Write them at:

374 Training Development Squadron/TST
118 S. Wolfe Avenue
Edwards AFB, CA 93524-6545

Note: Contractors MUST submit their requests through their SPO.